POPULAR SCIENCE

FEBRUARY · 35c *Monthly*

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Build Your Own Magnetic Engine

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The Truth About Truth Serum

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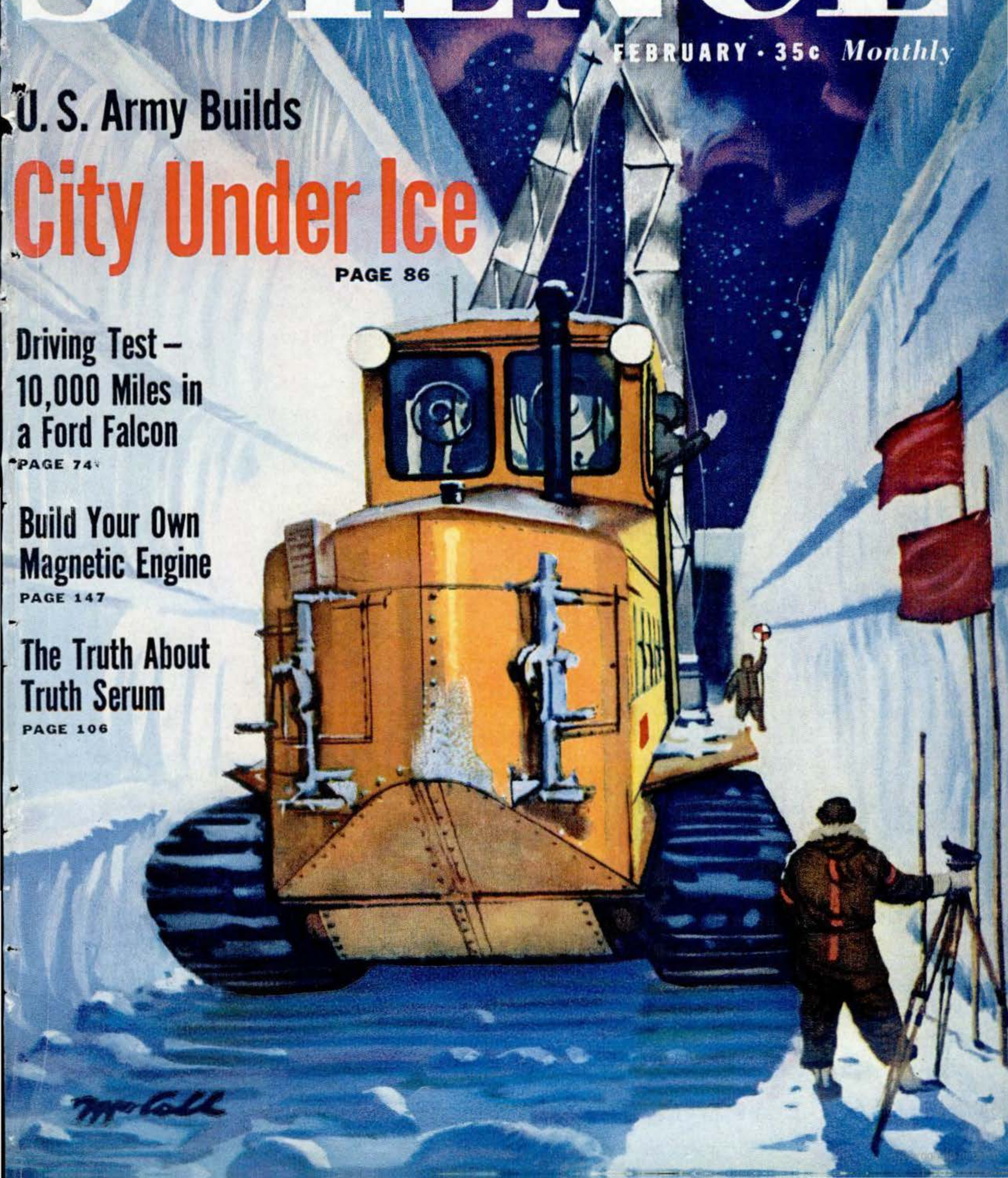

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- **Helps pay those higher-than-ever doctor and hospital bills!**
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Whether you now have partial protection, or none at all, it will pay you to get complete information now on these desirable, low-cost Commercial Travelers guaranteed continuable coverages. So fill out the card right now, while the matter is uppermost in your mind. It may well be the most significant card you ever mailed.

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THESE ARE SOME OF THE NUTS AND BOLTS AND SCREWS THAT WERE NOT PUT INTO THE BODY AND FRAME OF THE 1960 PLYMOUTH.

They just can't loosen and rattle because they're not there. The Solid 1960 Plymouth's new Dura-Quiet Unibody is welded around 5400 times.

Ordinary unit body construction isn't particularly new. But *this* kind is!

Chrysler Corporation pioneered unit building in 1934 and turned out the first welded-unit American passenger cars. Later, the method was adapted by other manufacturers. But there were problems, in the way of noise and vibration, and chance of rust and corrosion.

Chrysler engineers kept the idea under study. To it, they applied the biggest digital electronic computer program in the auto business. They used methods developed in the building of space missiles. They built an "electronic highway" to simulate all kinds of road conditions.

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Unibody Plymouth is made to *stay* quiet and solid for an unusually long time. Corrosion is licked for years to come by the greatest protective treatment ever given an American car. This Plymouth is, we believe, the best-built, best-performing car in the low-price class. Try it!

Body and frame are welded as one unit with Dura-Quiet Unibody construction.

SOLID PLYMOUTH 1960

A Chrysler-engineered product, built a new solid way to give you solid satisfaction.

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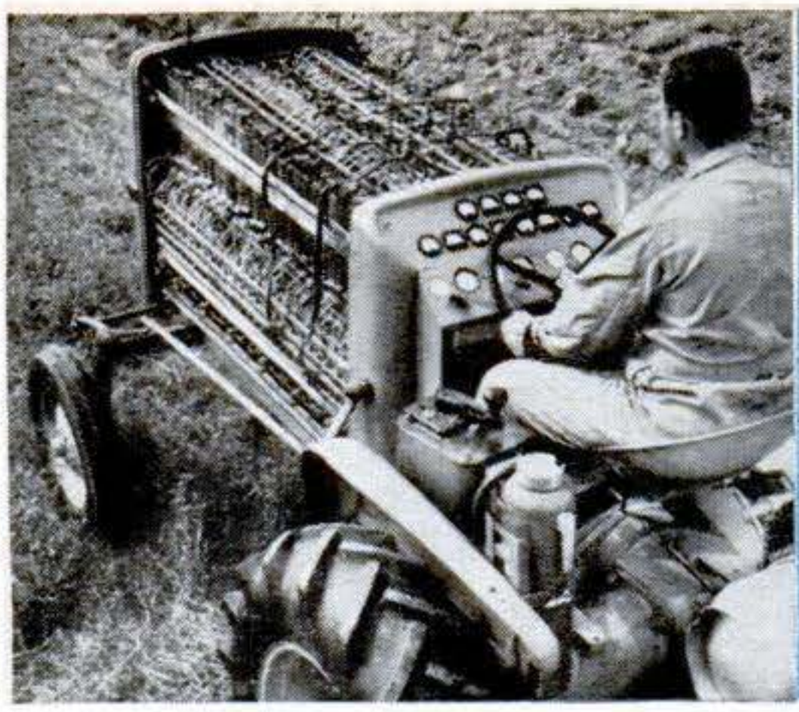

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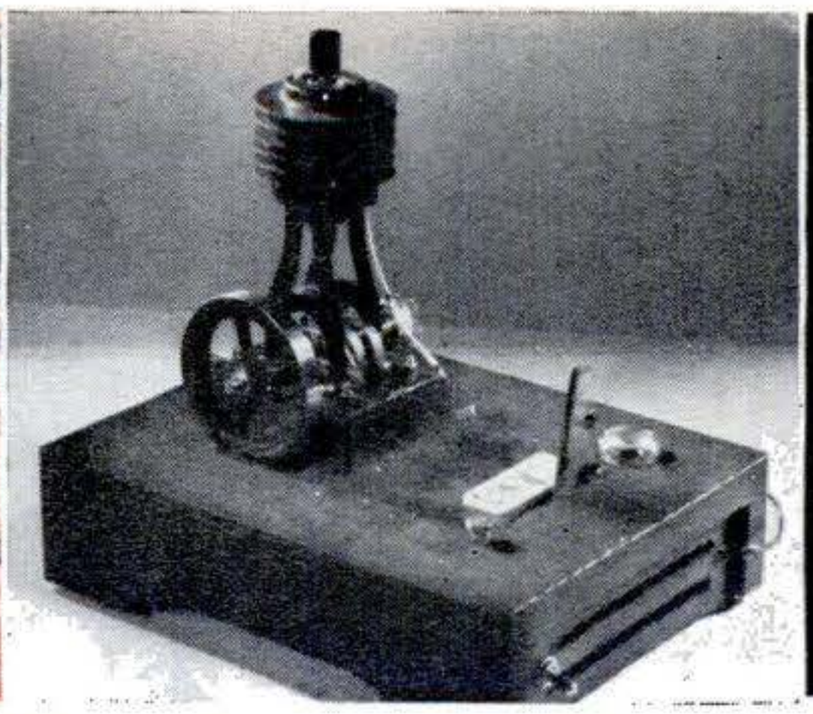

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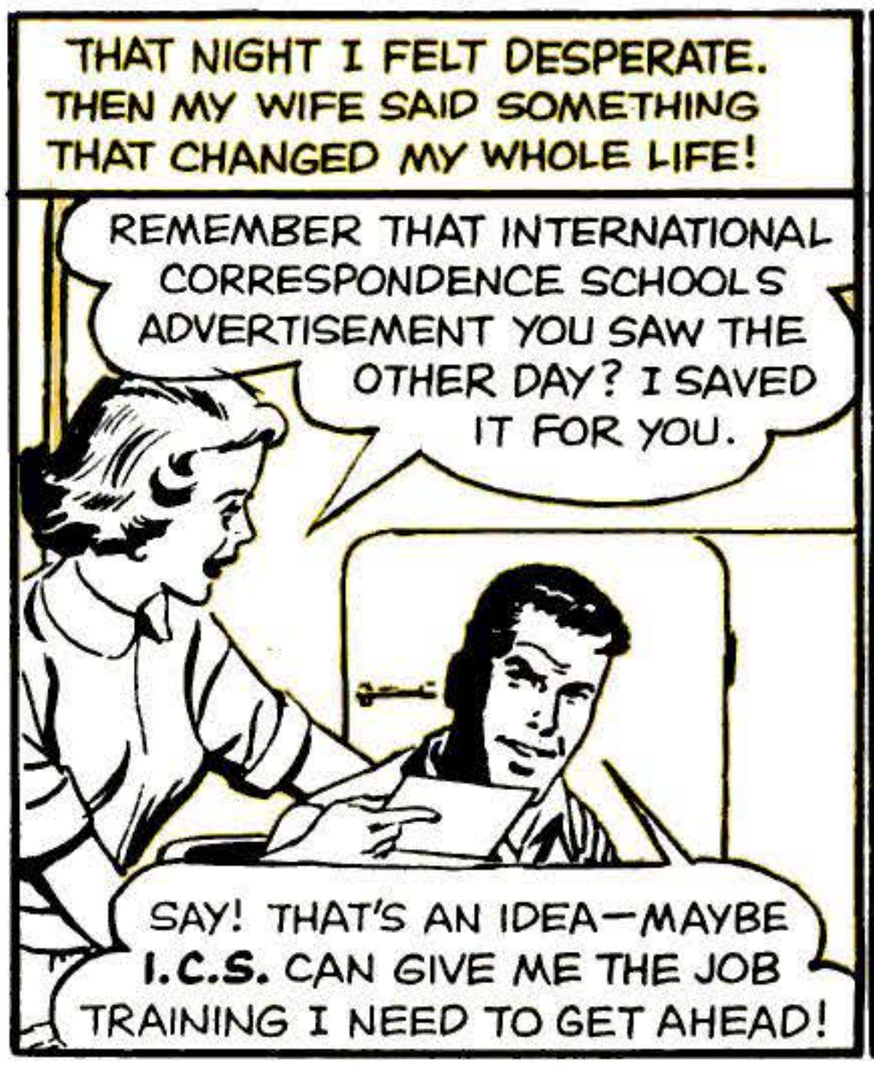

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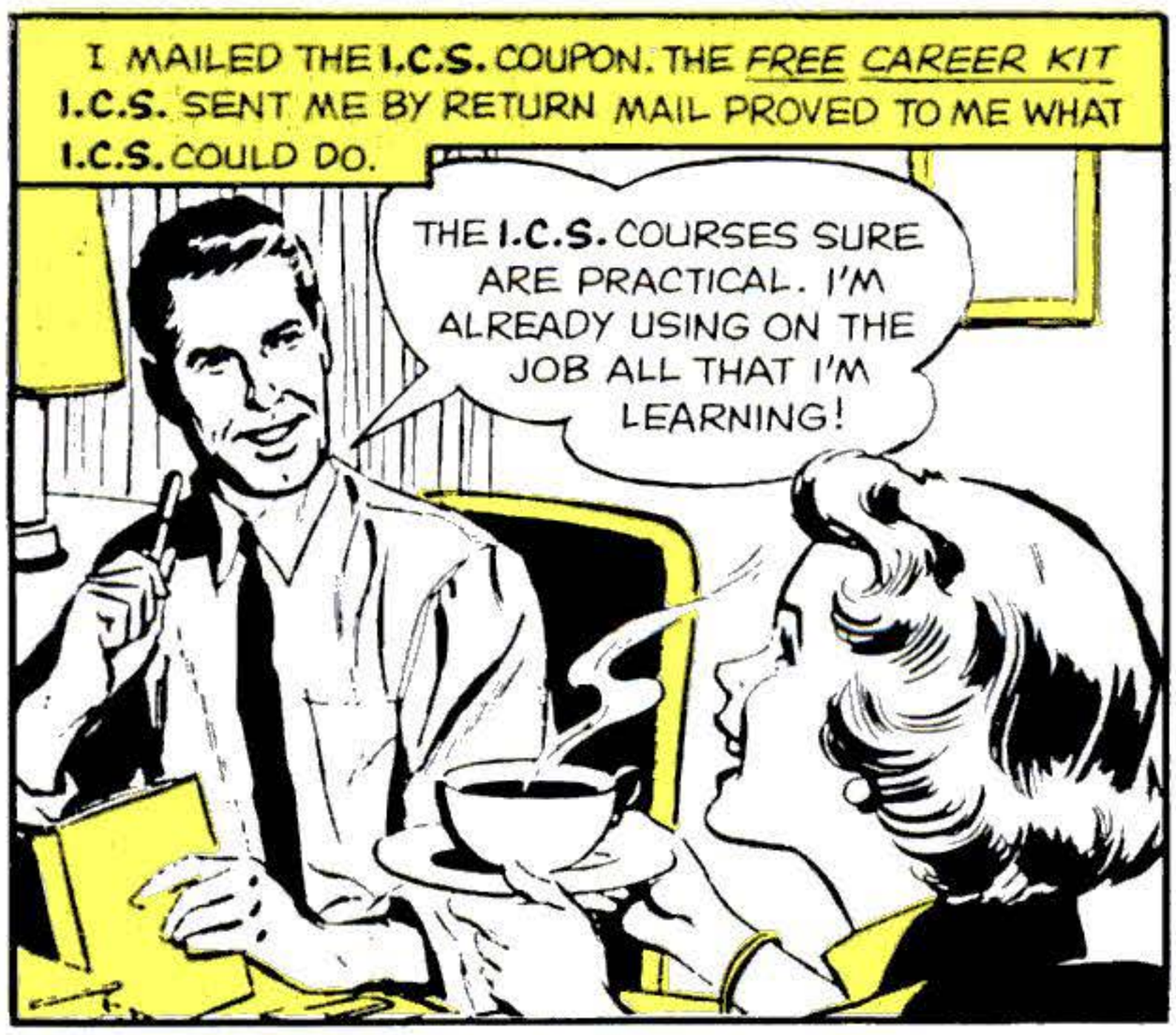

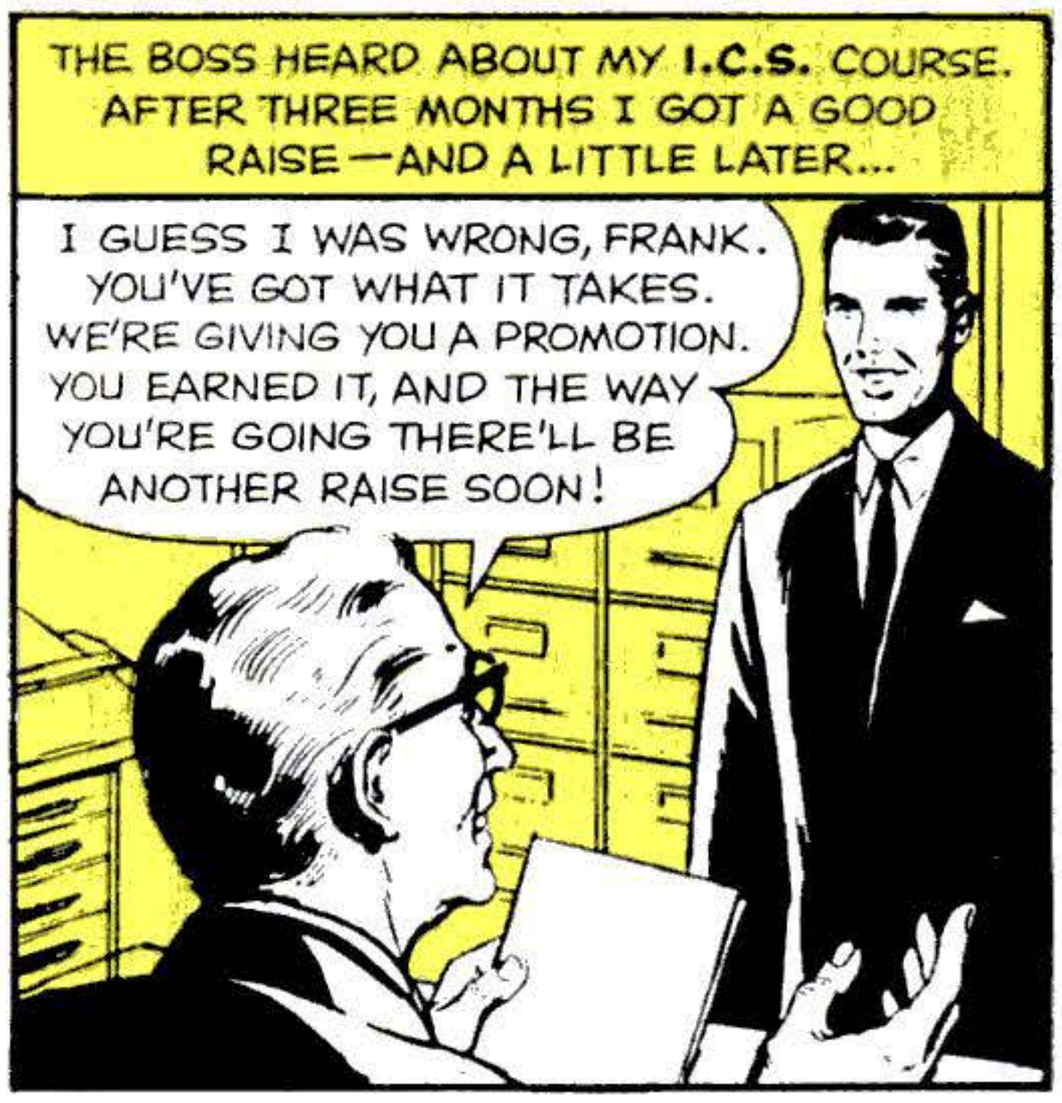

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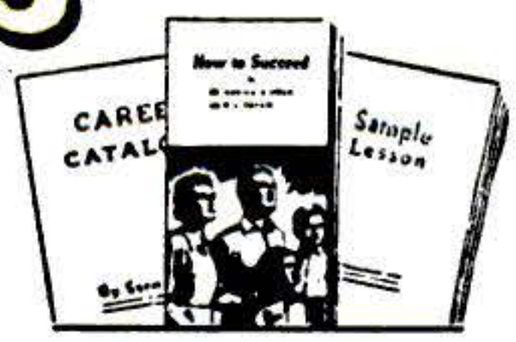

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PS Readers TALK BACK

Gus Beats a Dealer

THAT worn cam that didn't operate the fuel pump in the Model Garage story [Nov.] brought back memories. I had similar trouble some years ago. On my first two trips to the garage (owned by the dealer for the car, at that) the mechanic insisted that it was ignition trouble that made me stall right on the main drag in the rush hour, or in my driveway.

The third time, he decided it was the fuel pump, pulled it, and found that the cam had worn a deep, rounded, overgrown notch in the pump-operating lever, so it wasn't lifted far enough. A welder was used to fill the low spot but the pump still didn't work dependably, so on the fourth trip a new pump was installed. No more trouble. I kinda wonder just what kind of metal was in that cam Gus discovered. Why did it wear down so much, rather than the lever, as in my car?

Still, soft cam or hard, Gus caught it on the first try.

W. E. DOUGHERTY, Lansing, Mich.

That Elusive Pearlash

THE "Old-Timer's Formula for Fine Wood Finishing" [Nov.] fascinated me. I had hoped to try it, but have not been able to buy the "pearlash" specified. I tried several drug stores, paint dealers, and even a couple of wholesale chemical houses, without success.

H. W. PENER, Vineland, N. J.

. . . FROM my drug store I got a bottle of small pellets labeled calcium hydroxide and caustic potash, and a warning that it's very caustic to the skin.

ERIK MILLER, Burbank, Cal.

Apparently old-timer Stanley's drug store is an old-timer, too; pearlash is the old-fashioned name for potassium carbonate (calcium hydroxide and caustic potash are not the right stuff). If your modern drug or photo-chemical store doesn't stock potassium carbonate, the Willoughby Co., 110 W. 32nd St., NYC sells it.

Mr. Stanley now emphasizes that the chemical won't produce results equal to "crude potash" obtained by leaching wood ashes. Your best bet is to make your own. Wet down wood ashes in a hopper, pass the drippings through the ashes several times to get the right concentration. A bushel of ashes will yield up to a gallon of lye. Caution: It's caustic.

He's for Pie-Pan Tail Lights

WHAT gives with that guy who hates to follow Ford tail lights ["PS Readers Talk Back," Oct.]? I suggest that he was blinded because he was guilty of one of the major causes of accidents: following too close. I've never been a Ford owner and probably never will be, but I do like their rear lighting. There is no doubt in a person's mind when the car ahead is stopping if it is a Ford.

M. REILLY, Kirkland, Wash.

Celluloid Aroma

A WORD on Smell-O-Vision films ["Have You Heard?" Nov.]: It's obvious

that you haven't been to the movies lately—most of them smell now.

JEFFREY FEINMAN, Brooklyn.

In the Bag

THAT man who cleans paint brushes in a plastic bag ["Short Cuts and Tips," Oct.] must have X-ray eyes. How else could he see the brush through dirty

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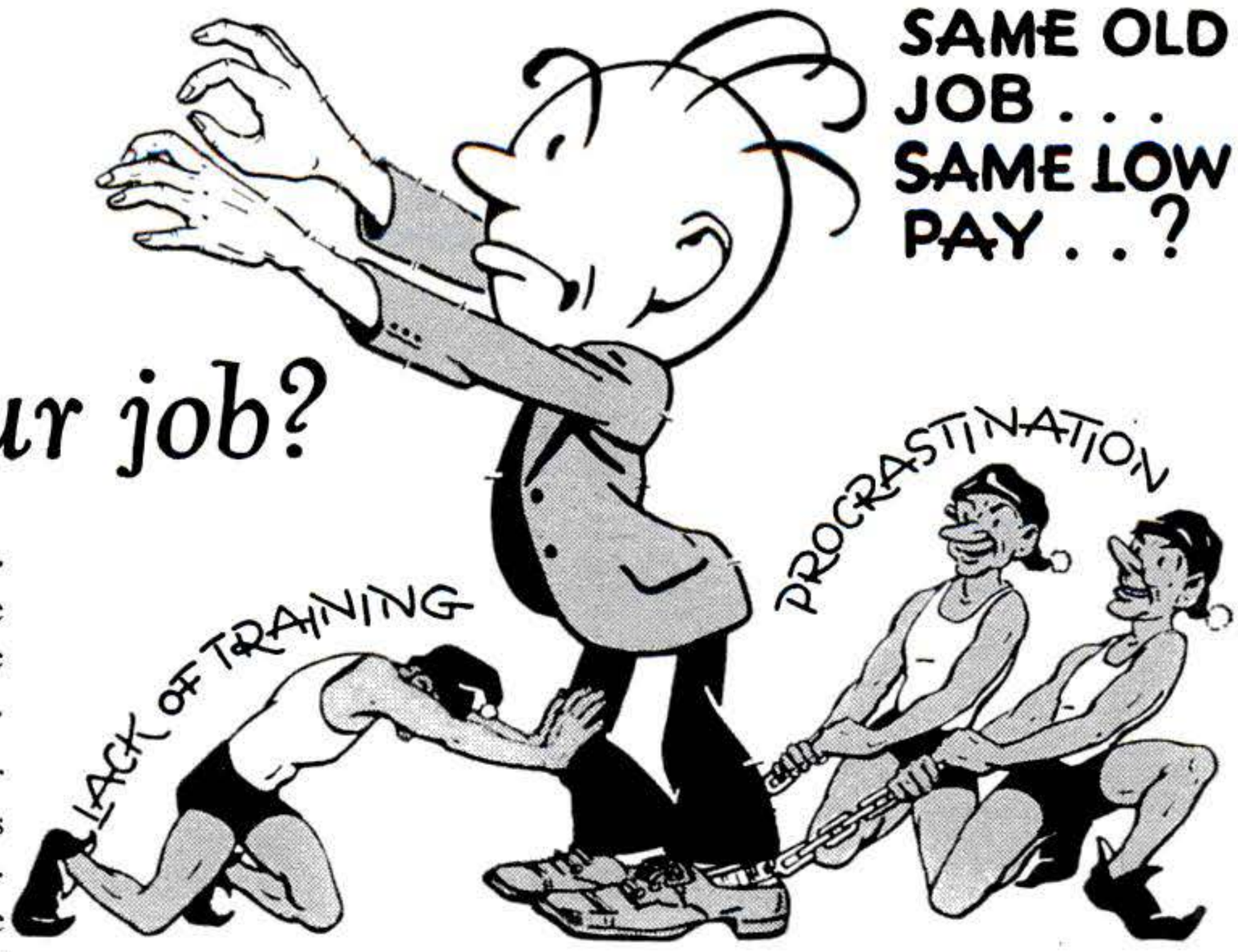
Are You "STANDING STILL" *on your job?*



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solvent, even if the container is transparent. And he'd better not loosen that grip with his right hand, either.

HENRY SCARTON JR., Canonsburg, Pa.

Hot Tip on Hot Wires

. . . While installing a 110-volt circuit in my garage, the insulated wires came in contact with my hearing-aid receiver. A loud and distinct hum was heard. Curious, I separated the wires and held them individually on the receiver. The hot one sure did sing. The neutral one was silent. Ever since, I've used this method to check for a hot wire.

E. E. STEWART, Plainville, Mass.

Wishful Thinker Stirs Doer

LAST summer, an I'd-like-to-see-them-make contributor suggested a manually operated light switch on station-wagon tailgates so you could light up the rear without opening a side door.

This sounded like a good idea and I found it easy to do. I bought a second light from the regular dealer—a duplicate of the one in the center of my wagon—and installed it just inside the tailgate. A few cents more for a few feet of wiring, a couple of hours on a Saturday afternoon, and one of the most convenient features had been added to the car.

It is easily reached from the rear and gives far better light to the cargo than the light at the center of the roof.

PAUL W. PENDELL, Sakbayeme, Africa.

If a Headlight Conks Out

RECENTLY one of my car's headlights burned out and I snapped on my turn signal. It was a fine emergency measure.

Try it out on a dark, lonely stretch of road, slowing down to 10 m.p.h. or less. It's surprising how much you can see in the brief flashes of light. I found that the right-turn signal is best as it lights up the nearest road edge.

H. J. PLATT, Omaha.

He Agrees Rewards Are Great

SINCE I've always needed a simple sheet-metal brake, I made the one shown in your November magazine.

Instead of the series of hinges you

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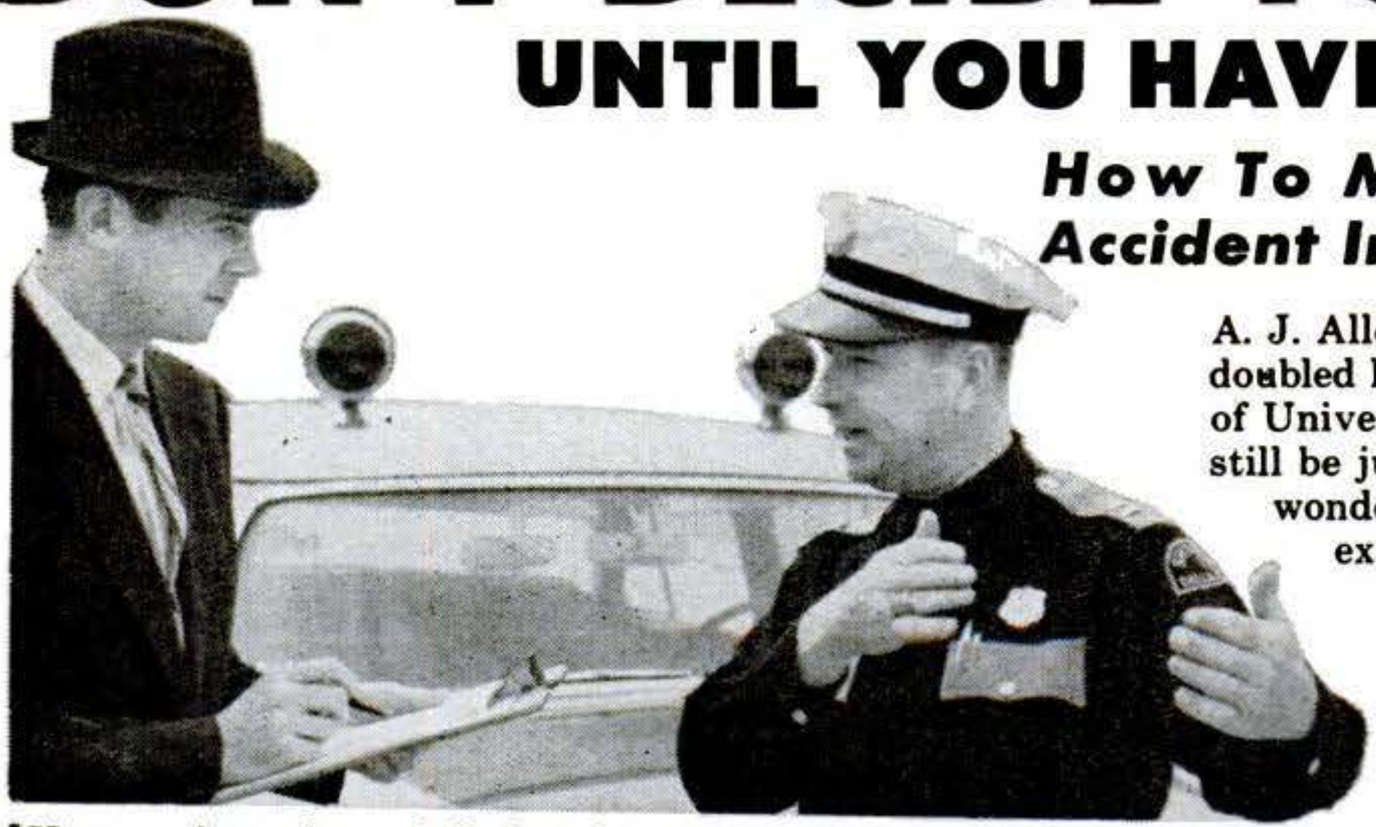
DON'T DECIDE YOUR FUTURE
UNTIL YOU HAVE READ
How To Make Big Money Fast in the Accident Investigation & Adjusting Field



A. J. Allen earned over $2,000 in ten weeks. Gary Williams doubled his former salary. Jessie Hill says "Had I not learned of Universal Schools' Accident Investigator Course I would still be just another time card puncher; but today I have a wonderful position, and I receive $3.00 an hour plus an expense allowance."

RIGHT NOW the Accident Investigation and Adjusting Field offers you a tremendous future. Here's why: *This vital business distributes more money than any other service industry.* Last year alone over 200 MILLION ACCIDENTS had to be investigated for Insurance Companies, Airlines, Railroads, Steamship Lines, and Government Offices — and the need for trained men is booming!

You can investigate full time for one company — or earn $3 to $10 an hour in *your own business.* No prior experience or higher education needed. And age is no barrier. Here is a field wide open to men 18 to 60.

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Send TODAY for new, illustrated Book mailed FREE. Learn how you can prepare at home in just a few weeks for excellent full time or **spare time** income. See for yourself how others have doubled and even tripled their earnings. Let us show you how Universal Schools has trained hundreds of men in their own homes spare time — and then helped them add thousands of dollars to their incomes. Absolutely no obligation on your part. No salesman will call. Write at once to me, M. O. Wilson, Universal Schools, 6801 Hillcrest Ave., Dallas 5, Texas.

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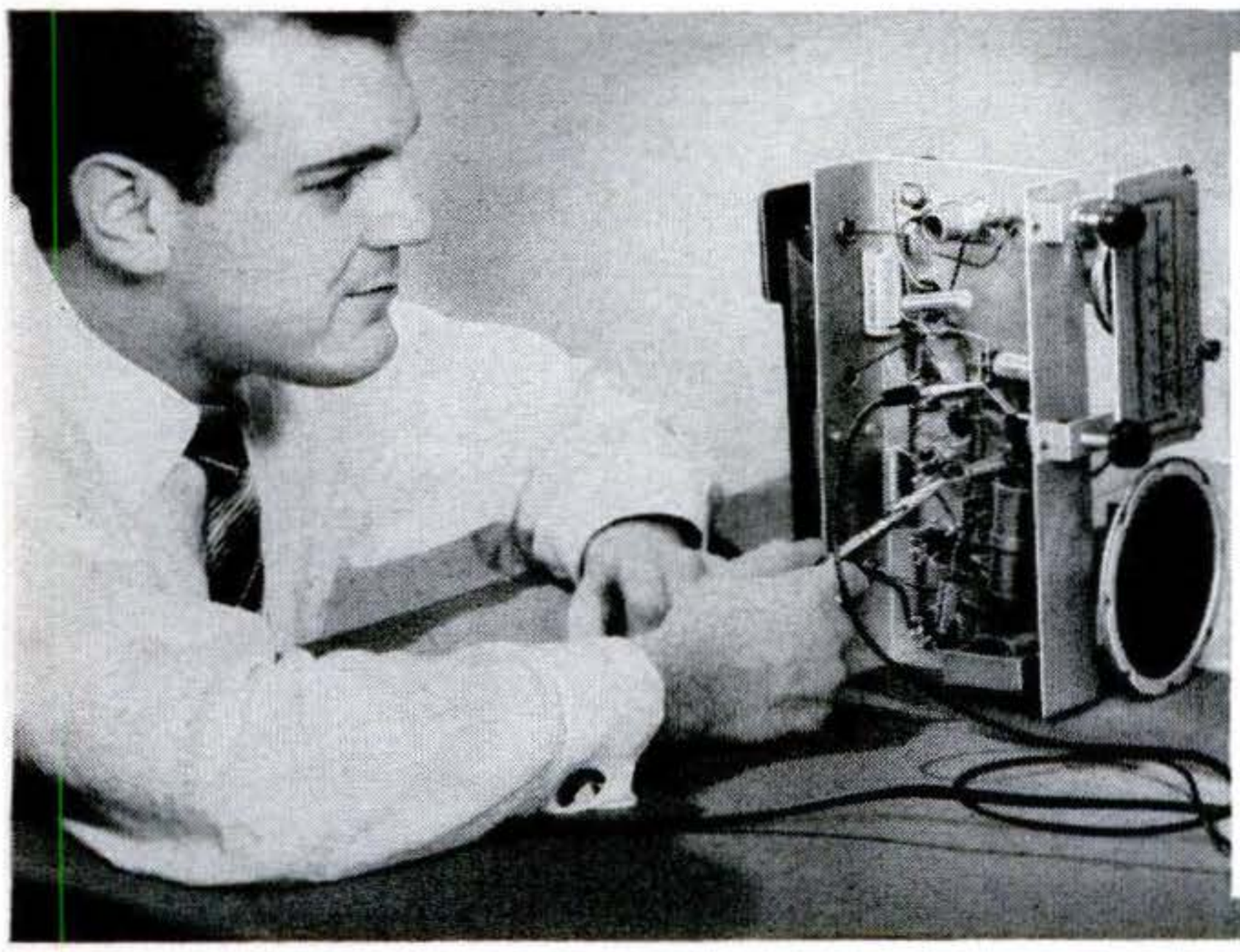
For a Successful Career in Radio-Television Electronics



Train at Home in Spare Time with N. R. I.

OLDEST and LARGEST

Home Study Radio-Television School

N.R.I. Trained These Men

ENGINEER STATION WHPE

"Thanks to NRI, I operated a successful Radio repair shop. Now I am an engineer for WHPE." VAN W. WORKMAN, HIGH POINT, NORTH CAROLINA

QUICK SPARE TIME CASH

"Knew nothing about Radio-TV when I enrolled. After 15 lessons started repairing sets. My future looks bright." DONALD B. ACKERMAN, MINNEAPOLIS, MINNESOTA

HAS OWN TV BUSINESS

"Quit my job to do Television work full time. I love it and do all right financially." WILLIAM F. KLINE, CINCINNATI. OHIO

Prosperous Fast Growing Industry Offers You GOOD PAY-BRIGHT FUTURE-SUCCESS

It's the trained man who gets ahead—gets the better job, drives a better car, lives in a better home, is respected for what he knows and can do. For a job with a future—find out how you can train at home for Radio-Television.

TODAY'S OPPORTUNITY FIELD

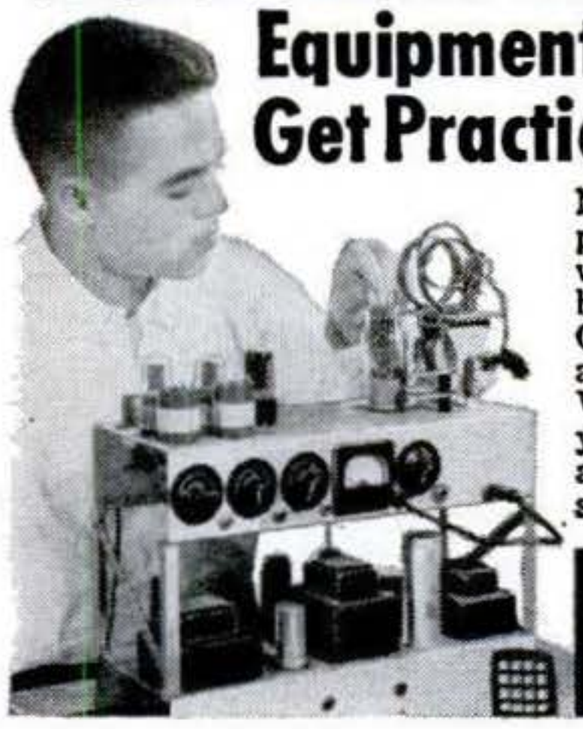
Training PLUS OPPORTUNITY is the ideal combination for success. And today's OPPORTUNITY field is Radio-Television. Over 125 million home Radios plus 30 million sets in cars, plus 40 million TV sets mean big money for trained Technicians. More than 4,000 Radio and TV broadcasting stations offer interesting and important positions. Color television, portable TV sets, Hi-Fi, assure future growth. Find out about NRI. Since 1914—for more than 40 years—NRI has been training ambitious men at home in spare time for Radio-TV. With NRI 50-50 method, you study basic principles AND learn by practicing with actual equipment NRI furnishes. You learn with your hands and your head. You get dependable training, backed up by the reputation of the oldest and largest home study Radio-TV school.

ADD TO YOUR INCOME SOON

$10-$15 A WEEK IN SPARE TIME

Soon after enrolling many start earning extra money fixing sets. Many open their own full time Radio-TV shops after getting NRI Diploma. MAIL COUPON. Get FREE Sample Lesson and 64-page Catalog showing equipment supplied, outlines of courses, opportunities in Radio-TV. Price is low—terms easy. Address: **NATIONAL RADIO INSTITUTE, Dept. OBB, Washington 16, D. C.**

Without Extra Charge NRI Sends Equipment You Need to Get Practical Experience



Nothing takes the place of practical experience. That's why NRI training is Learning-by-Doing. With Servicing Course you build Radio shown at top and other equipment. With Communications Course you build Transmitters at left and other equipment. Catalog shows all equipment you get.

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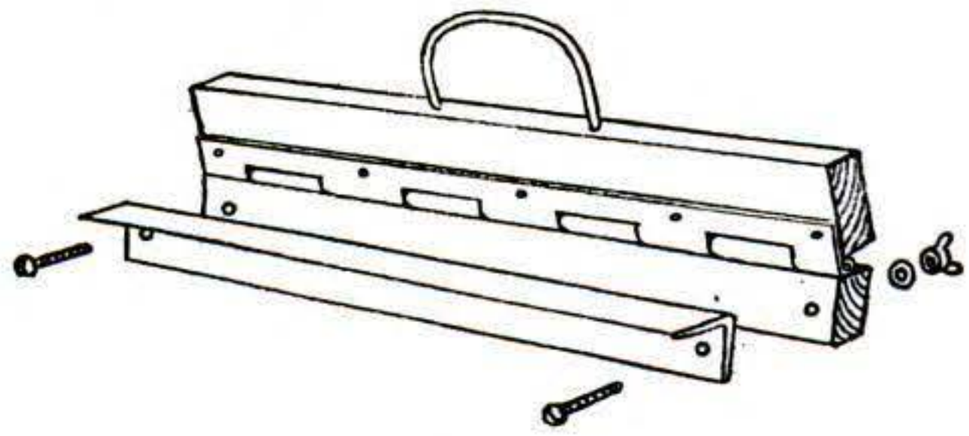
Pliobond BY GOODYEAR

Pliobond—T. M. The Goodyear Tire & Rubber Company, Akron, Ohio

suggest, I used a piano hinge for greater strength and accuracy. I also substituted an angle iron for the front jaw and mounted it to the back jaw with ¼"-20



screws and wingnuts. Thus I don't need the vise or the C clamp to hold the work. By cutting the holes in the center of the end, you can turn over the bar to make a fold greater than 90 degrees.

All in all, I'm very happy to have seen this simple brake. I've made several projects with it, including a 50-drawer parts rack fashioned after the plastic ones I have in my camera-repair shop.

IRVING FRIEDMAN, Bronx, NYC.

How Do You Measure 'Em?

YOU say the proposed Staten Island-Brooklyn bridge will be the world's longest suspension bridge ["Picture News," Nov.]. I am afraid this will not go down so well with the Mackinac Bridge Authority, because the "Mighty Mac" is 8,614 feet long. That's 1,924 feet longer than your candidate.

However, the center suspension span of the N. Y. bridge (4,260 feet) will be longer than those of the Mackinac (3,800 feet) and the Golden Gate Bridge (4,200 feet).

AJIT VAIDYA, Columbus, Ohio.

How to Discourage Starlings

I HAVE the answer for any PS readers who want to keep starlings from edging out other birds. We have two bird feeders set up on posts. They bring in all sorts of small birds, but I believe I've rid our five acres of ground of all starlings.

I made a wooden frame of lath for each feeder. The frame is just square enough to fit under the aluminum lid, and the laths are spaced just far enough apart so that the smaller birds can get under and in to the food. After I put these up, the starlings for a while tried in every way to get at the food, but couldn't reach it. I even saw some looking underneath to see if there was another way. Finally,

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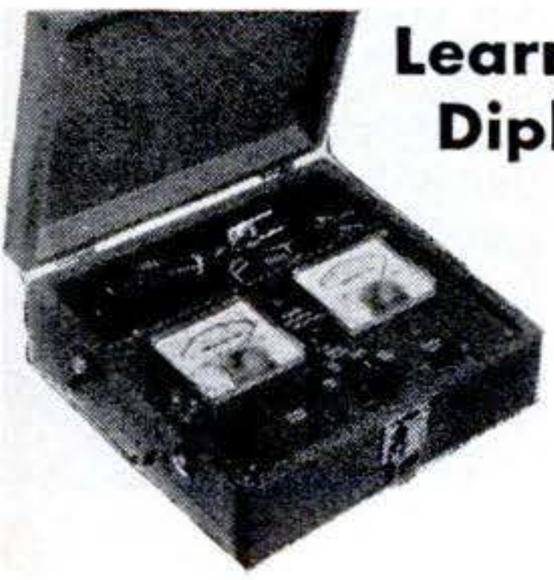
Appliances are necessary to comfortable, convenient living. Owners pay well to keep them in repair. The field is amazingly big. In addition to major appliances such as electric ranges, air conditioners, refrigerators, there are over 40,000,000 electric irons, 5,000,000 electric blankets, 15,000,000 coffee makers, plus more millions of vacuum cleaners, fans, toasters, mixers, etc.

Find Out What Appliance Repair Offers You



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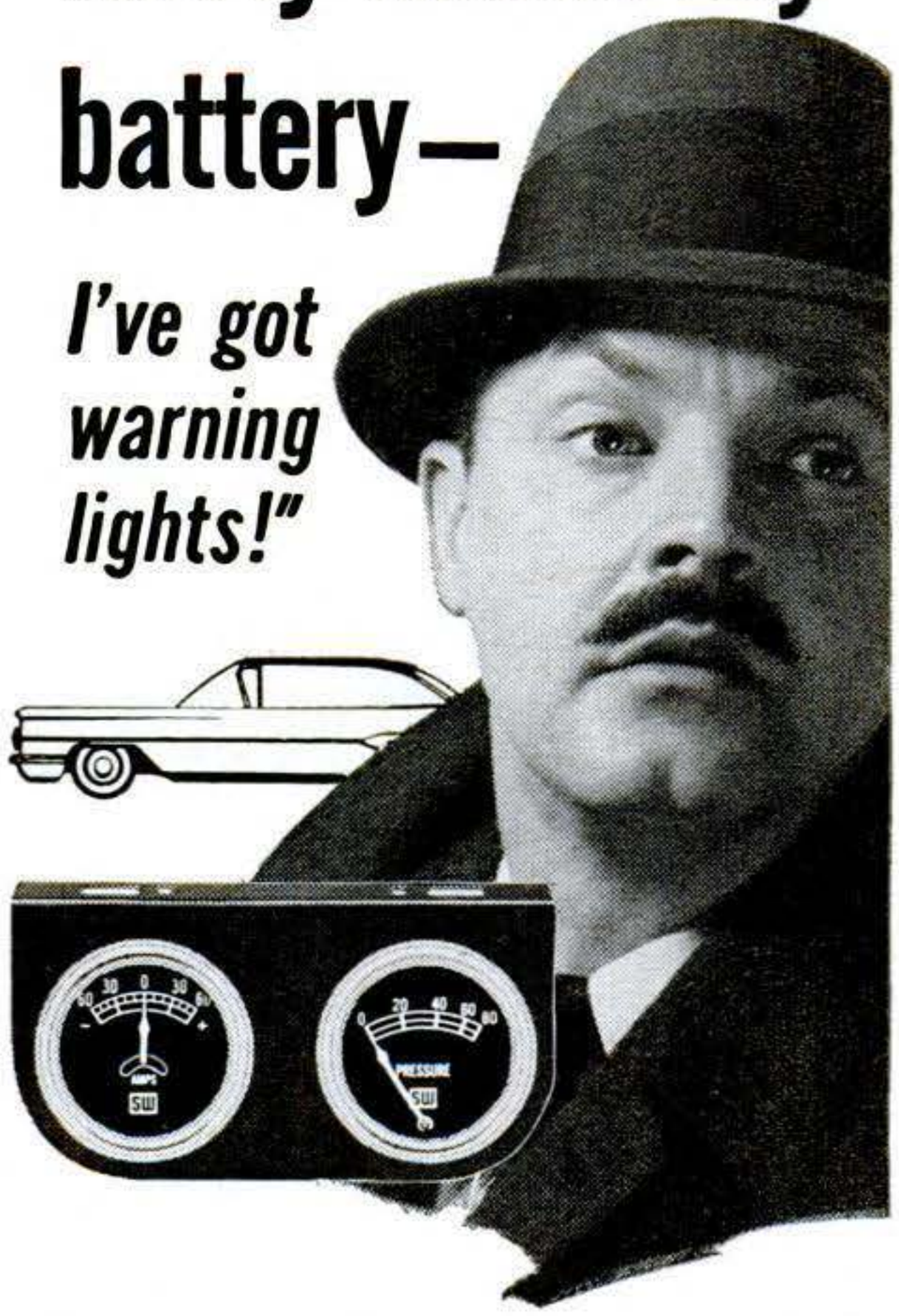
"Why should I worry about my battery—

I've got warning lights!"



Warning lights for your battery and oil pressure are not enough! Your car needs a Stewart-Warner "Twin Gauge" Panel. Here's why: A generator warning light indicates only that your generator is not delivering a charge. But the ammeter in the "Twin Gauge" Panel tells actual *rate* of current flow...helps prevent generators from burning out and overcharging or discharging of battery. And the Stewart-Warner Oil Pressure Gauge in the Twin Panel tells *exact* oil pressure, helps assure safe engine operation. Choice of standard black enameled steel as illustrated or deluxe panel of Colonial White grain finish Royalite.

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the setup so discouraged them that we haven't seen one starling around our place for several months.

HARRY TORNQUIST, Harbert, Mich.

Wail from an Old-Car Fan

I HAVE a few words to say about the Tom Henderson cartoon showing a draped car [Nov.] with the underline: "Jim's so ashamed of our old car."

Anyone who owns an old car such as the one pictured is mighty lucky. I know

I'd give my right arm to catch hold of one. Really old cars are rare and, when found, usually quite expensive. So if I were Jim, I would be very proud.

STEPHEN BLUCHER, Detroit.

The wife misunderstood. He was covering it to prevent weathering.

Honest, It Works

AFTER studying "A Wiring Trick that Saves Wire" [Nov.], I wonder if the diagram on page 159 is supposed to show on-off operation of two outside lights with control by two switches? That's quite a trick, but it will work only if you eliminate the light on the porch.

SGT. L. SLEPIN, USMC, Olathe, Kan.

. . . I'D SAY you're implying something not true in your wire-saving hookup. Namely, that the lights can be turned on or off from either switch at any time. The lights, when on, can be turned off from either switch; but they must be turned back on by the switch that turned them off.

JAMES WAITE, Nampa, Idaho.

. . . SEEMS to me you missed a possibility. Your wiring diagram would also permit one or more post lights between house and garage, as well as simultaneously controlling both entrance and garage lights.

F. G. MCCOLLISTER, Clarksburg, Ohio.

. . . MY GARAGE has an unswitched out-

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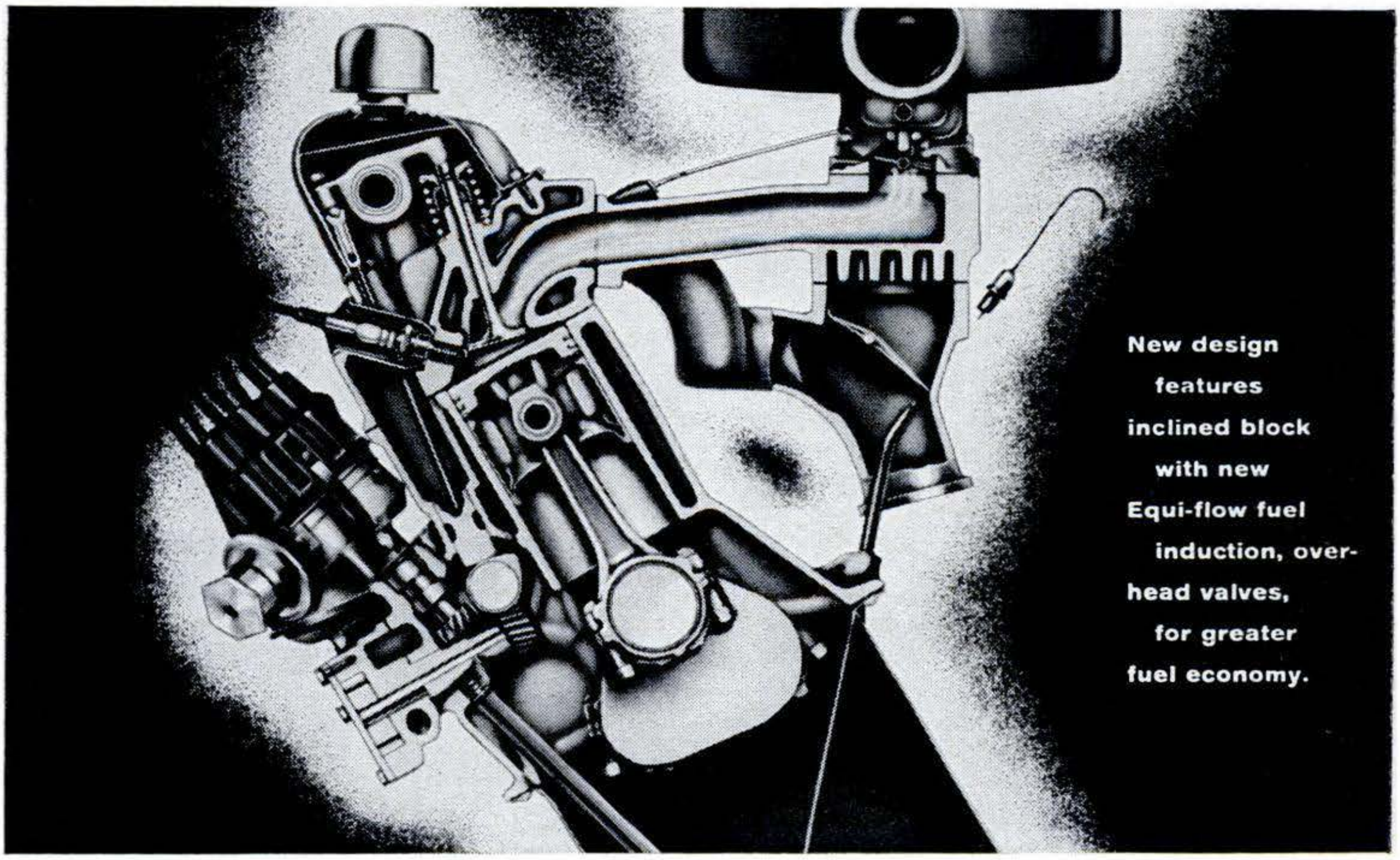
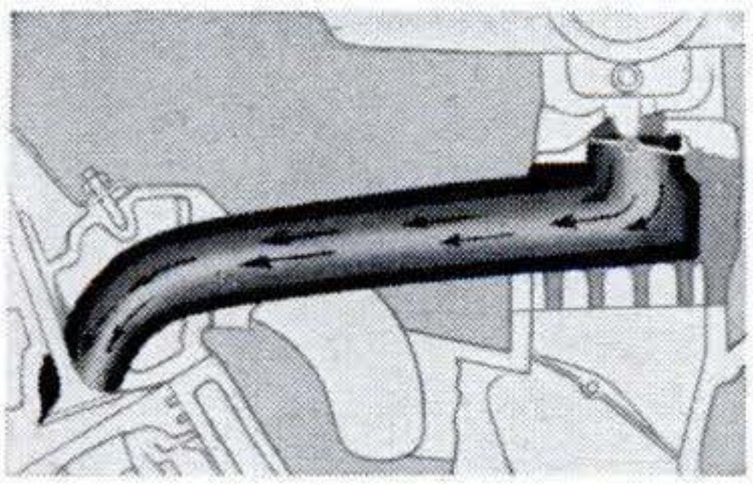
Low-Priced Dodge Dart Features Revolutionary New Engine

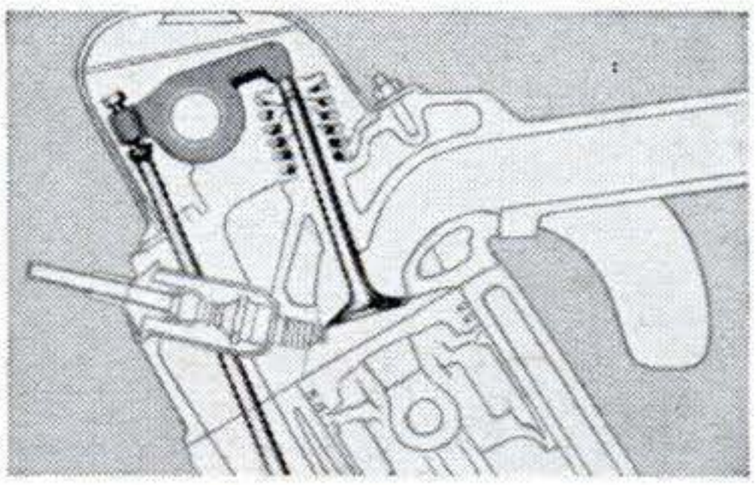
New Economy Slant "6" Uses Exclusive Semi-Ram Intake Manifold!



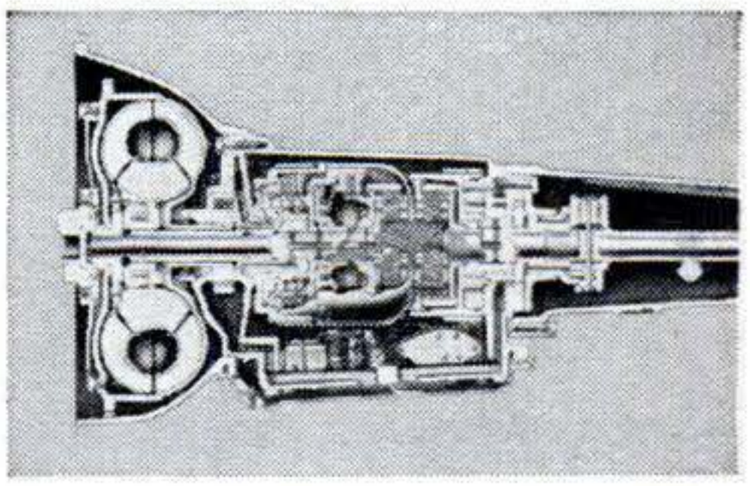
Packing surprising performance with the kind of gas mileage usually found only in much smaller cars, this new Economy Slant "6" represents a major breakthrough in engine design. The 225 cu. in. block is angled 30° to the side to allow for special free-breathing intake and exhaust manifolds. High-turbulence wedge-shaped combustion chamber and carefully selected 8.5 to 1 compression ratio deliver 145 h.p. at 4000 r.p.m., using regular gas. Special high-efficiency camshaft puts top torque right down in useful driving ranges. Output: 215 lb.-ft. at 2800 r.p.m. Uses new velvet-smooth Free-Flight Power engine mounting.



Special slant-block makes room for this new semi-ram intake manifold. Exclusive Equi-flow design provides more efficient, evenly balanced distribution of fuel to all cylinders.



Big, overhead valves mean better breathing, better distribution of fuel mixture inside cylinders. More even burning means extra power and mileage from every gallon of gas.



Special TorqueFlite Six is the first automatic transmission designed specifically to match the power-torque curve of a six-cylinder engine. (Optional at extra cost.)

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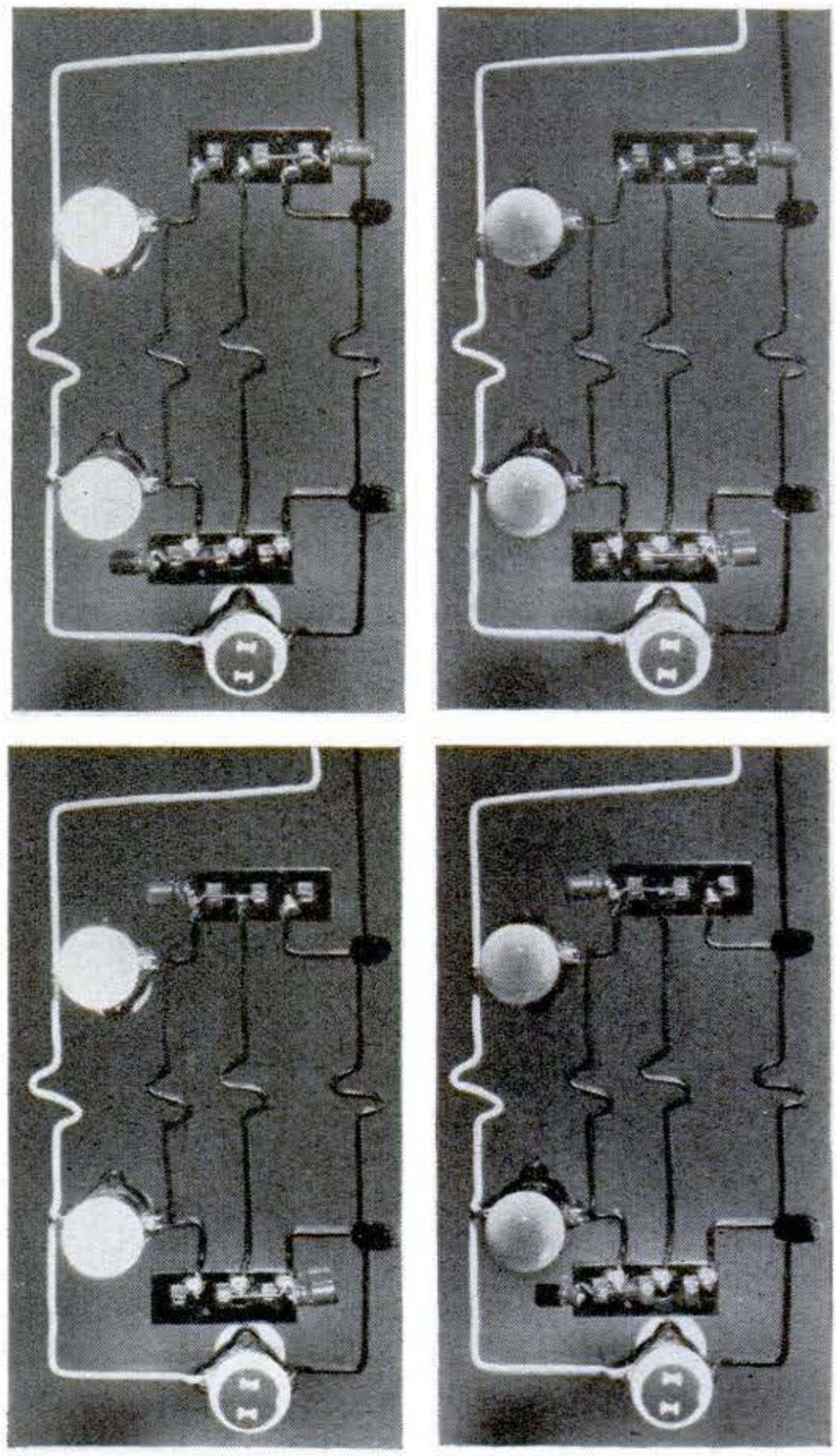
let, plus two-way switches for controlling the garage light, all accomplished with only three wires. The third wire used for light control reverses polarity, depending on how the switches are thrown.

H. J. GRIEF, San Angelo, Tex.

1. Either switch in the circuit has OFF and ON control of both lights—see pho-



tos of circuits in all possible positions. Remember that house-wiring switches have snap action with no dead center.

2. Post lights could be tied in anywhere along the line.

3. Reader Grief may come to grief unless he has found out how to sidestep code rules against switching a ground leg, how to prevent dead shorts, and how to avoid a tingling sensation in the switch finger with possibly lethal results.

No Upside-Down Cars on Mirror

I WAS interested in the periscope for autos ["Detroit Report," Nov.] because I had a similar idea for gaining a decent

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In Spare Time at Home—Prepare for a Better Job—or Your Own Business in One of the Many Branches of

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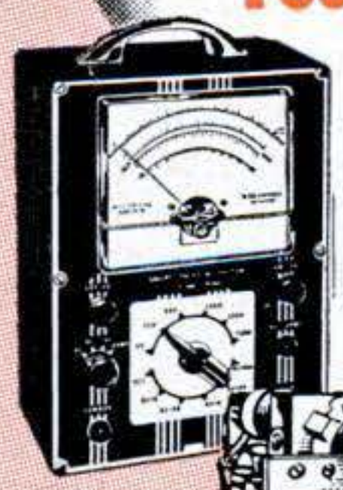

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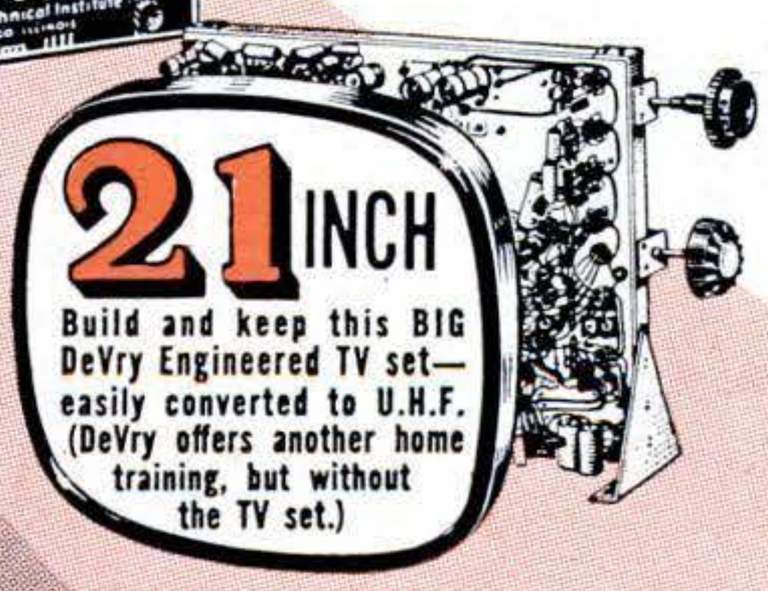

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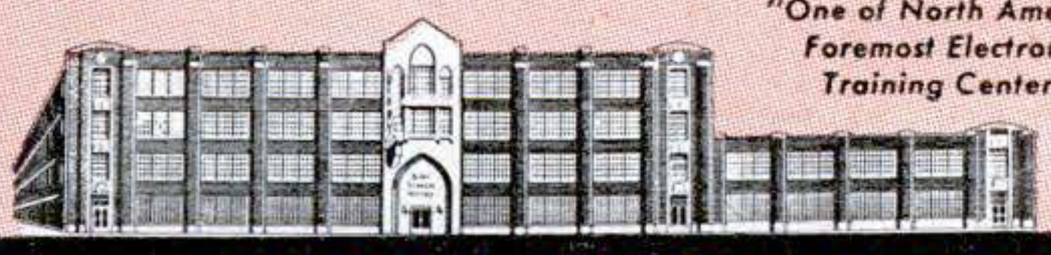

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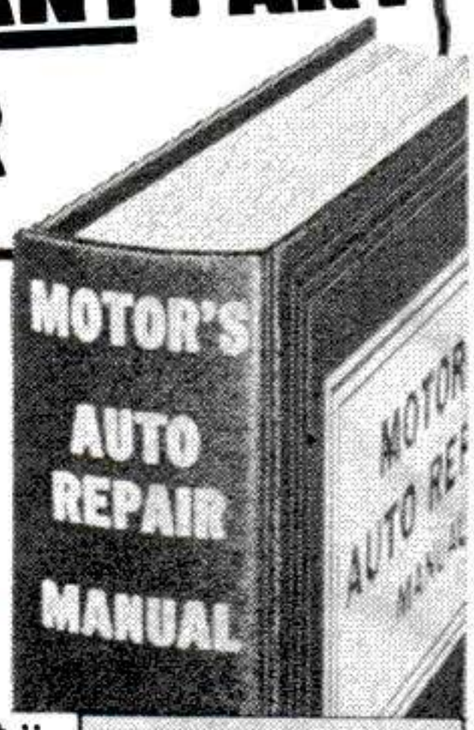

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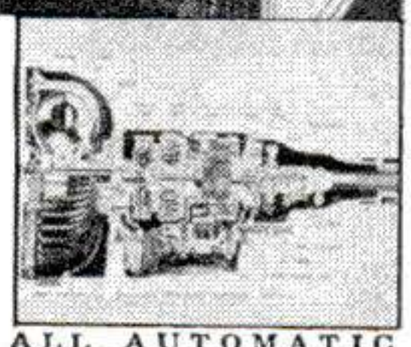

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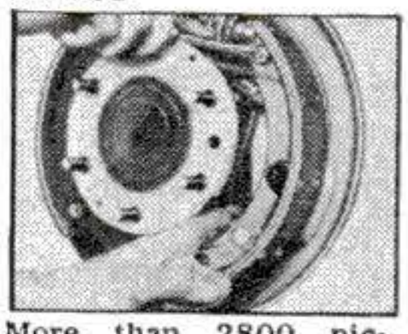

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field of rear vision. (Detroit should be ashamed of that little bit of reflector they put on $3,000 worth of merchandise.)

This, I thought, would be an improvement—until I checked and found that two simple mirrors (as shown in your illustration) would make the following car appear to be upside down. This would take a lot of getting used to!

R. U. STRASSER, Skokie, Ill.

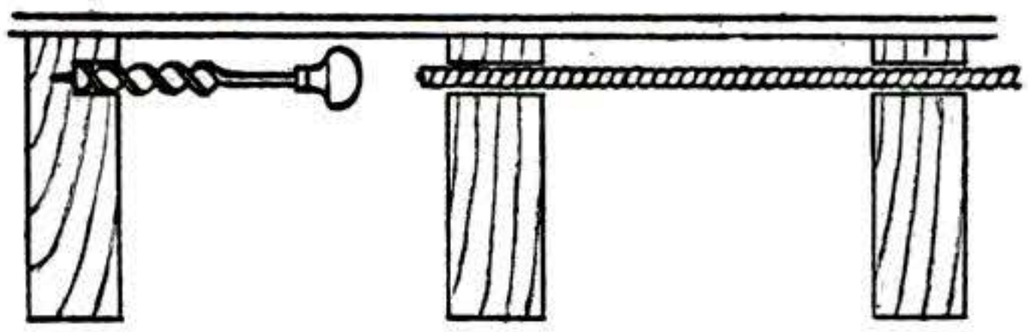
. . . PERISCOPES for cars may be feasible but, as illustrated, wouldn't the driver see everything behind him upside down?

E. ROBIDOUX, Los Angeles.

Right. Two flat mirrors wouldn't work. But, in its simplest form, the car scope uses three optical elements. There is an objective lens—cylindrical on one surface and flat at the other—at the rear opening of the roof tunnel, a plane mirror at front to reflect the light down at a small angle, and a concave cylindrical driver's mirror.

His Brace Is a Doorknob

WHY make angled holes in studs or joists when boring to string electrical cable ["Short Cuts and Tips," Oct.]? It's a lot simpler to make straight holes up near the flooring. You get a neater job and you don't weaken the joist as much. With a sharp bit and a doorknob for a



brace, holes can be bored in line even in close quarters.

W. C. MCCANSE, Springfield, Mo.

Motors, Not Electric

WE READ with considerable interest your article "Hole to Probe Mysteries Inside the Earth" [Nov.]. We'd like to offer one correction, however.

You mention an offer from "General Electric to lend a million dollars' worth of diesel-electric generating equipment." Actually, such an offer was made by the Electro-Motive Division of General Motors at the annual research conference sponsored by the Southern Research Institute in Birmingham, Ala.

ROBERT D. INNES
General Motors Corp., LaGrange, Ill.

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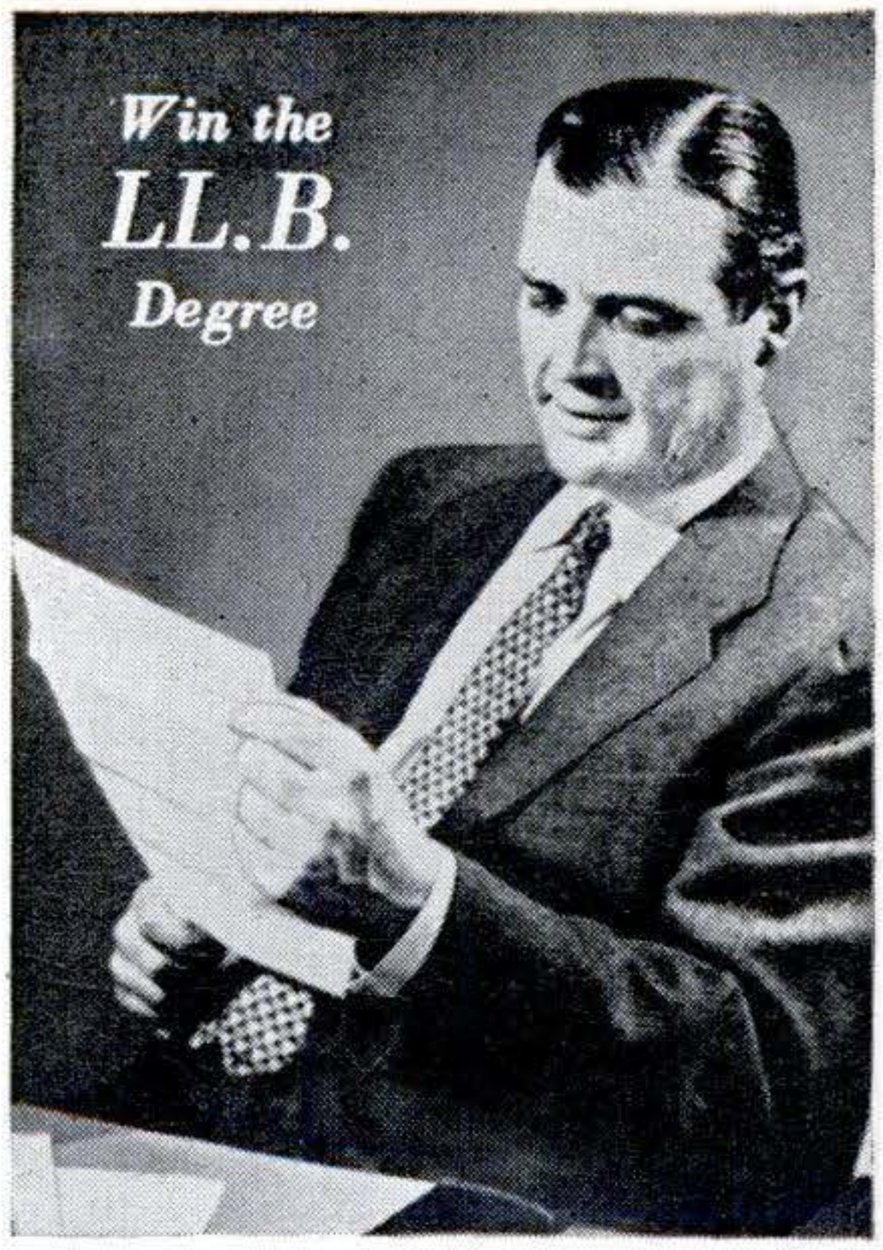
CASE #1 Jones wrote Smith making an offer. Smith wrote his acceptance and mailed it. Then he decided to call it off and telegraphed Jones to that effect. Jones got the telegram before he did the letter. May he hold Smith to the contract?

ANSWER. Yes. Both Smith and Jones became bound when the letter containing the acceptance was mailed.

CASE #2 Doe said to Crane, "I will sell you 100 shares of XY stock at $50." Crane said, "I'll give you $45." Doe, knowing the market was unsettled, said nothing, but an hour later tendered 100 shares and a bill for $4,500. May he hold Crane?

ANSWER: No. Crane's counter-offer was a rejection of Doe's offer.



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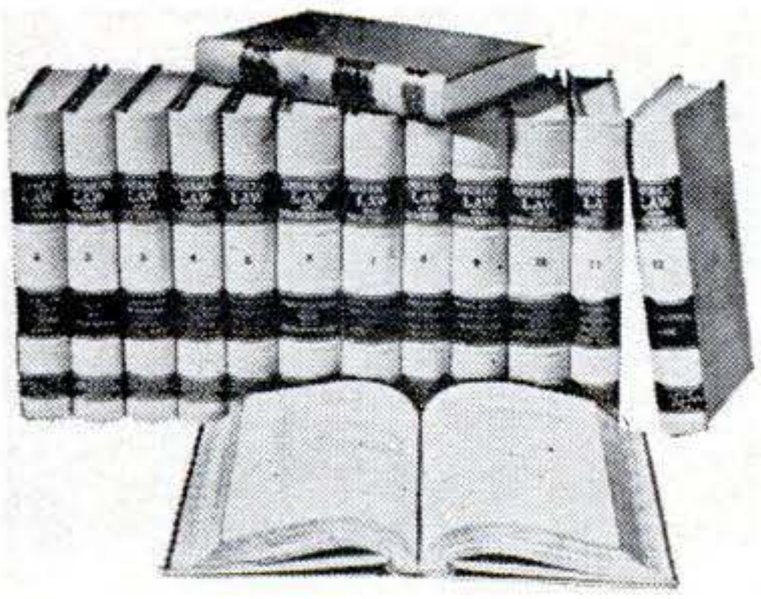

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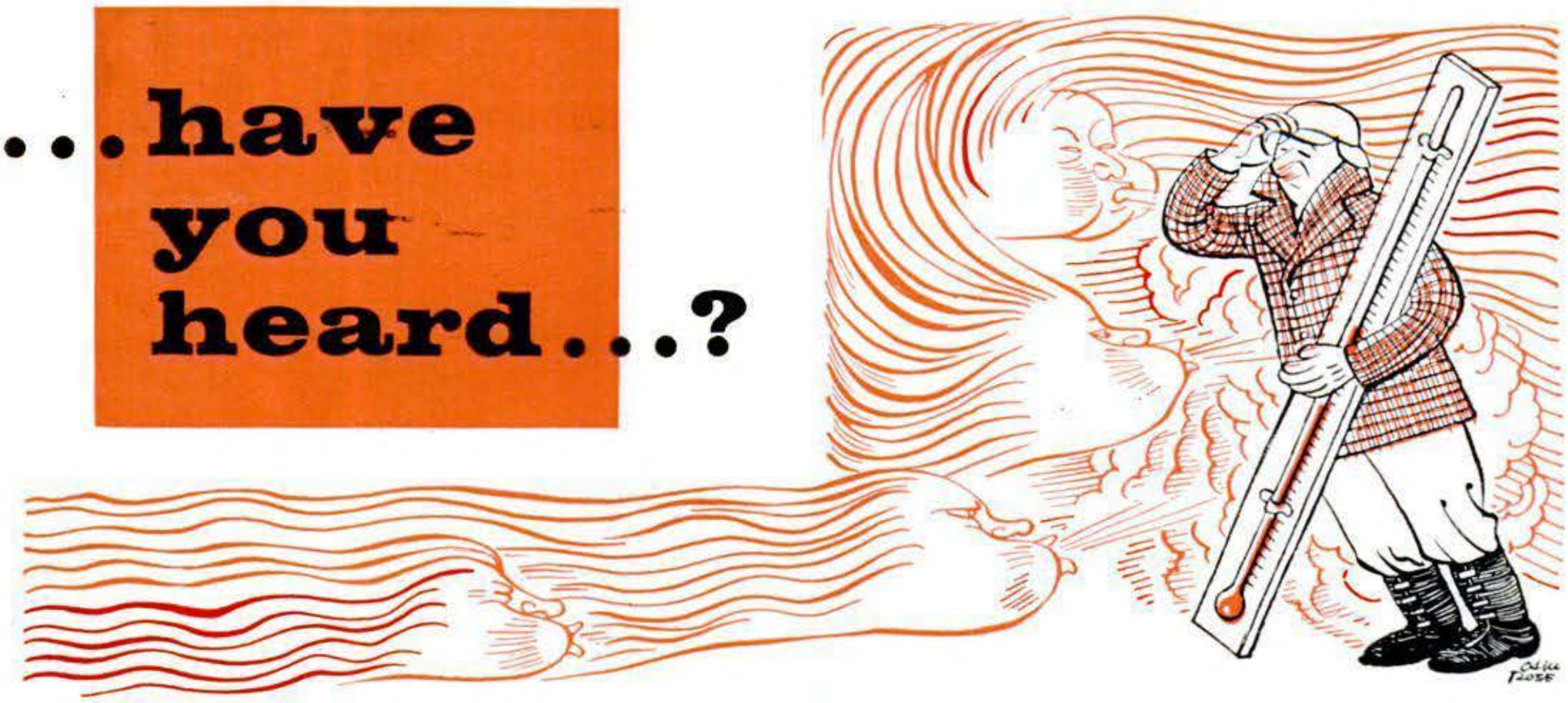

It's colder out than you think—if there's a wind howling as well as an icy dip in temperature. Your skin, normally at a temperature of 91.4 degrees F., loses heat much more quickly when there's a wind fanning it. You end up as chilled on a warm but windy winter's day as you do on a day when the thermometer's really nose-dived, but when there's been no blast. Army medical researchers now stress both factors when studying the endurance of soldiers in cold climates.

The difference wind makes is startling: A 20-m.p.h. wind at a temperature of 34 degrees F., for example, will cause the same heat loss from your skin in an hour's time as a temperature of 38 below—with no wind.

Credit for the new look at the weather goes to Dr. Paul A. Siple, who collected the data in Antarctica.

To use the chart:

1) Find the column with the heading showing current wind speed.

2) Read down until you find the figure closest to current temperature.

3) Read across to the entry in the "0" column. This is the equivalent temperature if there were no wind.

TEMPERATURE (degrees F.) / WIND SPEED (miles per hour)	45	35	25	20	15	10	5	3	2	1	0
	90	89½	89	88½	88	87¾	87½	87	86	84½	83
	82	81	80½	80	79½	78	76	74	72½	70	60
	72	71	69½	68	67	65	60	57	53½	47½	23
	63	61	59	57	55	52	44½	39	34½	20	-11
	51	49	47	45	42½	38	28	18½	11	0	-27
	41	39	36	34	30½	25	11	0	-9	-23½	-38
	30	28	25	23	18	11	-5	-16½	-40		
	20	18	14	11	6	-2	-19	-40			
	10	7½	3	0	-6	-15	-35				
	0	-2½	-8	-12	-18	-29					
	-11	-14	-18	-23	-30						
	-21	-24	-30	-35							
	-32	-35	-40	-40							

Below —40°

Source: U. S. Army Medical Research Laboratory

Do you ever get "velocititis"? That's the word Columbia University's Safety Institute researchers coined to mean the loss of sense of speed that makes driving at 60 m.p.h. seem like 40, and slowing to 25 to make a highway exit seem as if the engine is stalling.

Nobody's immune to "velocititis," or to another evil—the hypnosis induced by long, dull stretches of highway, says Dr. James L. Malfetti, the Institute's director. So it's not fair to blame "lack of driver education" for accidents that are not the driver's fault. There are inherent limitations that no one can overcome. To compensate, designers and highway engineers ought to build more safety into the car and onto the road.

For cars, Dr. Malfetti feels, the ultimate solution is electronic controls—automatic devices that would be coordinated with the known abilities of the driver:

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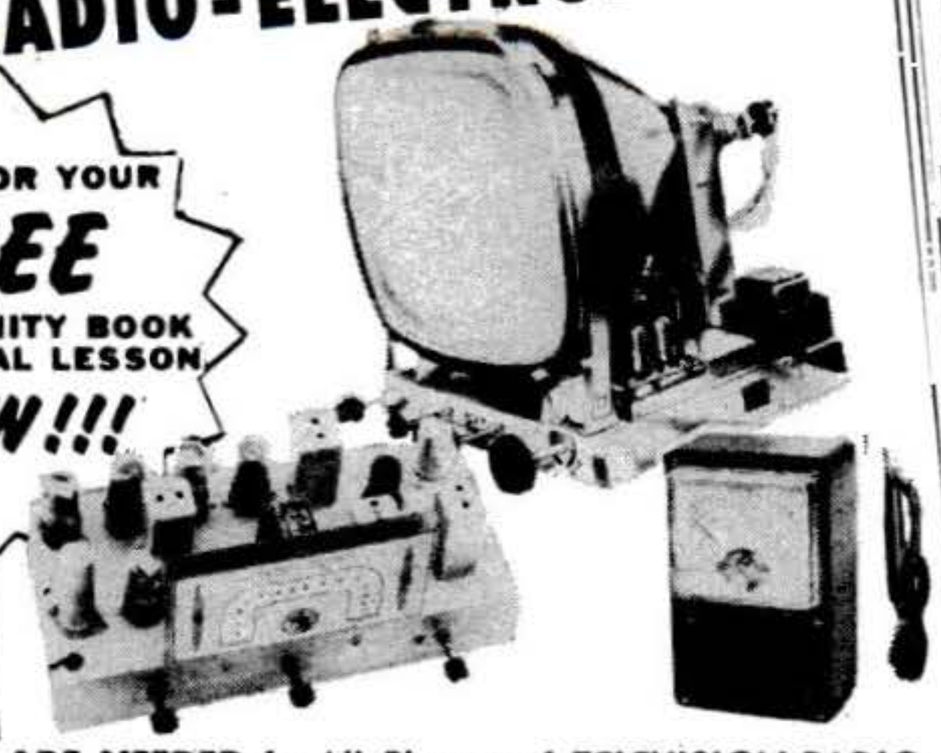

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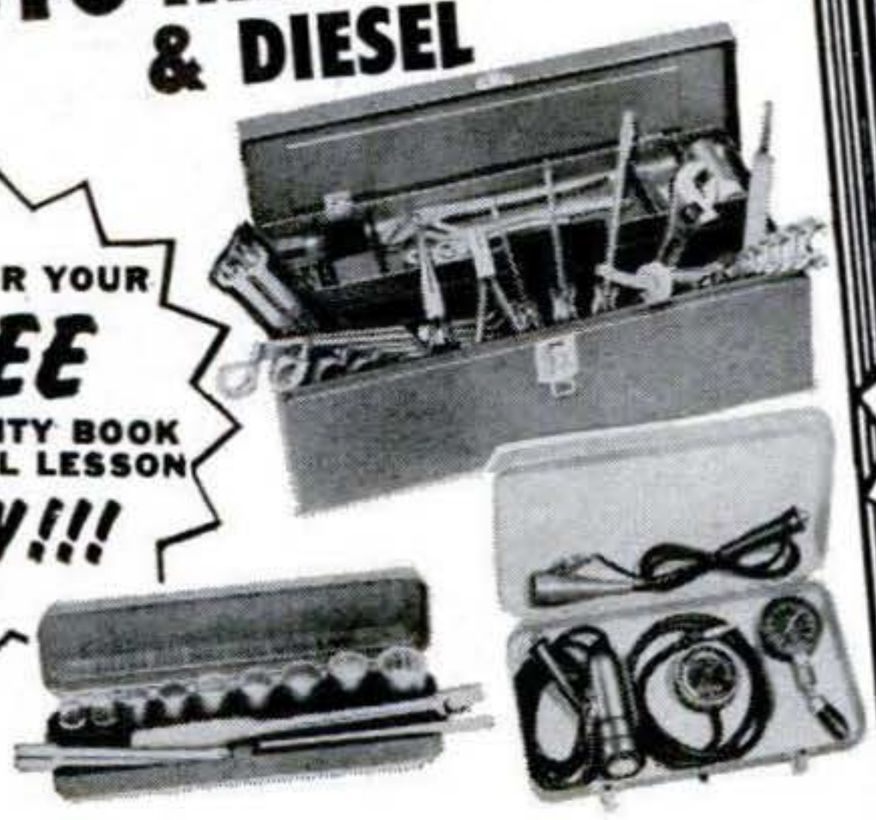

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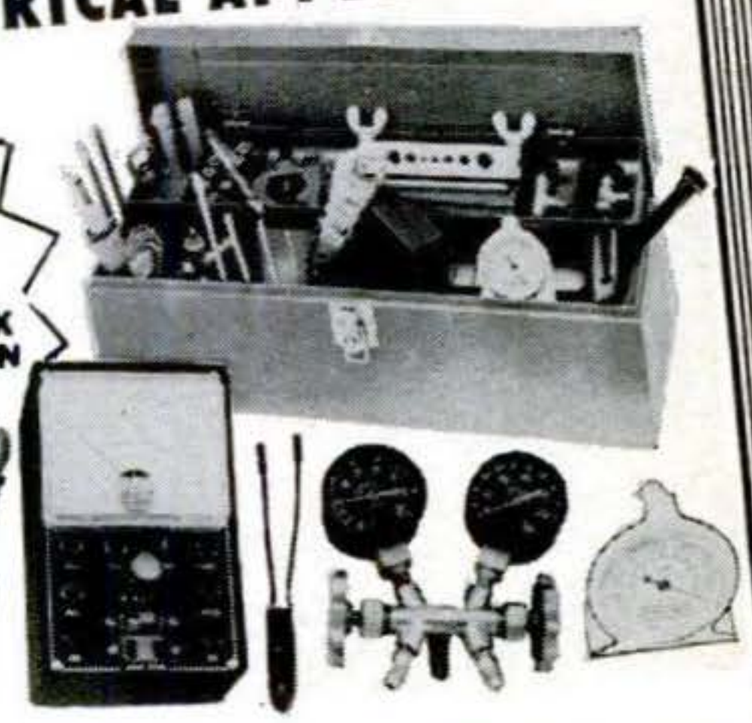

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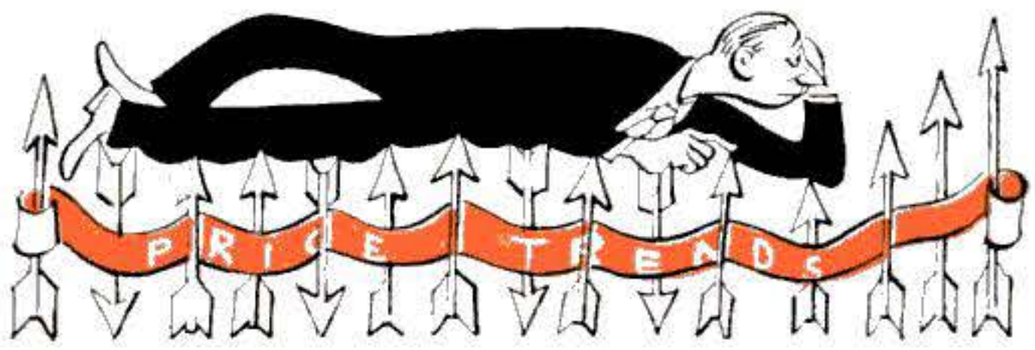
the strength of his steering-wheel grip, his heart rate, the number of head movements he makes, etc. The controls would be triggered at preset limits to warn the driver if he were getting out of control. If necessary they could even take over.



On the price front. What costs will go up, what down in 1960? Here's how experts see it:

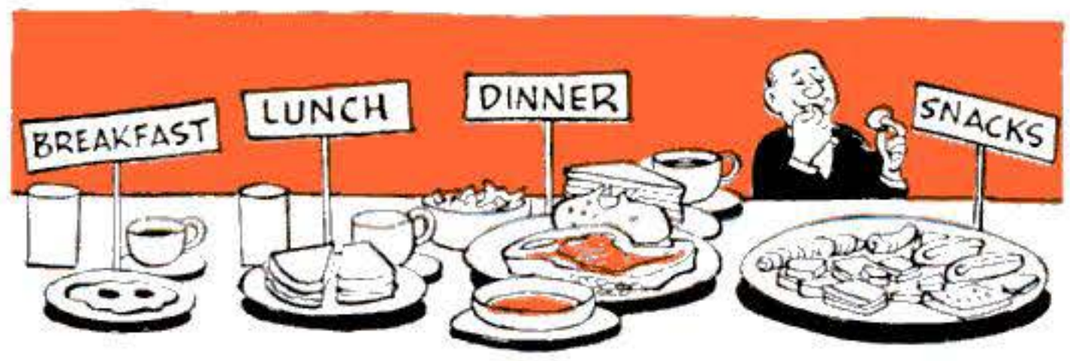
- Lumber—down. Partly because of overproduction, partly because fewer homes will be built. (Lumber companies blame the latter on tight money and the steel strike.)
- Plumbing supplies—up. There'll be a five-percent across-the-board increase in prices for bathtubs, sinks, and other standard fixtures.
- Electrical appliances—up. A deluge of price-cutting followed the demise of company-fixed "fair trade" prices. But since then, prices have started spiraling again, and will continue. Two strong factors affect appliance prices in opposite ways: The price and availability of steel nudges prices up; fear of foreign competition urges them down.
- Food—in general, down. Meats continue in good supply—pork at bargain prices through 1960, beef following suit in '61.
- Shoes—down. There's been a drop in hide prices.
- Men's suits—up. Heavy textile buying pushed prices up. Designers will try to make last year's suit "obsolete" to move new ones off the racks.

Foiled by a woman! Lone bank robbers should never underestimate the power of a woman teller:

Last year 74 lone-wolf bandits were frustrated in holdups, more than half—39 of them—by quick-thinking ladies.

All told, robbers pulled off 268 bank holdups in the year ending August 31, according to the American Bankers Association. They stole $1.4 million.

Three square meals a day? They may be the ruin of you, according to biochemist Dr. Clarence Cohn of Chicago. The strain of peak demand on your inner organs may touch off heart and circulatory ailments.



Children seem to know instinctively when and what to eat, says Dr. Cohn. There's no reason, except ingrained habit, for man not to live by "demand feeding," too. In fact, he suggests the day may come when the conventional lunch hour will be replaced by short "food breaks."

That mysterious arrow poison, curare, long used by South American Indians (and by mystery-story writers in search of the perfect weapon), has been synthesized in the lab.

The drug, derived from a calabash plant, has important muscle-relaxing qualities. Prof. Paul Karrer of the University of Zurich reports that several Swiss hospitals are testing the man-made version in operations, to relax the patient and reduce need for anesthetics.

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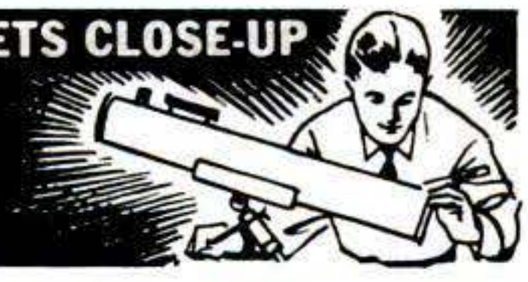

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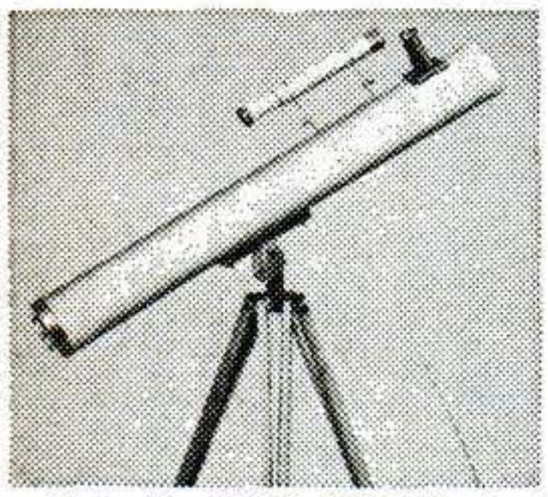

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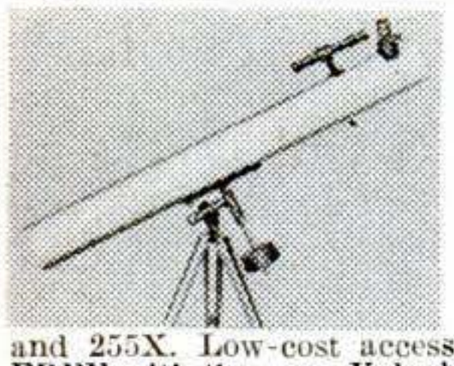

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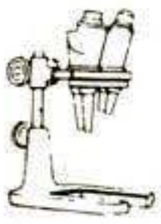

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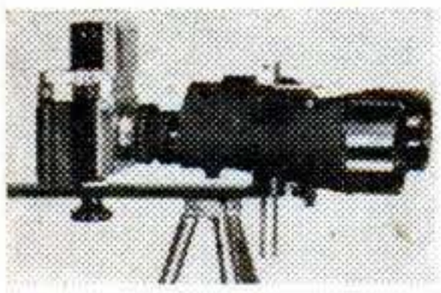

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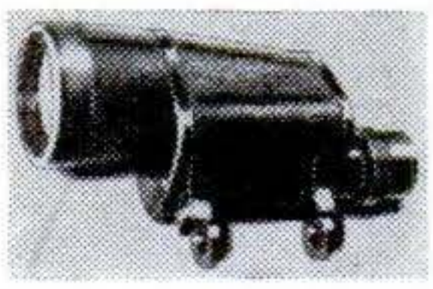

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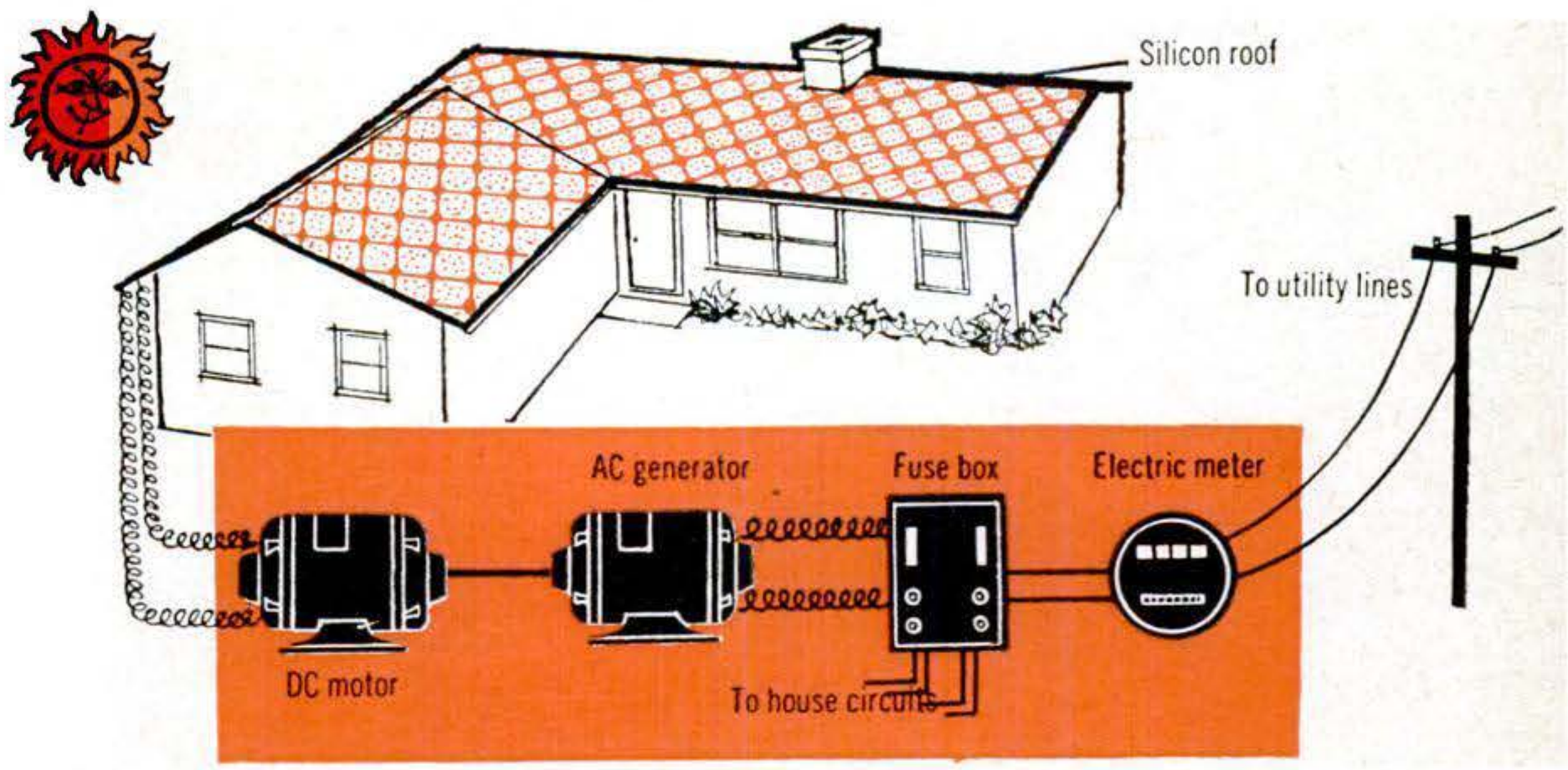
The month in science

Every home a power plant. The tantalizing fact is that the sun pours 100 to 200 kilowatts of absolutely free energy onto the roof of your house, and all this does is melt snow and heat up the attic. Such waste has long upset penny-conscious engineers, even more so now that pretty good sunlight-to-electricity converters are available. Recently L. F. Giacoletto, a Ford scientist, took a hard look at the practical problem of making sun-on-the-roof run the family lights, toaster, and TV set. But don't break off relations with the power company yet; home sun power is still not worthwhile by a long shot (see p. 69 for another power idea).

One problem is storage. You need most electricity when the sun is not shining. Giacoletto's solution is the scheme tried with windmill generators: Feed homemade electricity that you don't need into the power company's lines. Distribution networks are already interconnected to cover very large areas of the country, so cloudy sections could use the surplus from sunlit sections. Your electric meter would run backward when you fed power into the system, forward when you took power out—you'd automatically get billed only for other people's juice you used.

Nights, of course, the whole U. S. is dark. The power companies' big stations would have to pitch in. Even then, though, homemade electricity could help. During the day it could drive big pumps to lift water into storage reservoirs; at night the water would run out to drive turbines, saving on steam costs.



To put this idea into practice, your house would have to be roofed with silicon solar cells (the kind used to power satellite instruments). They would feed a DC motor in your cellar. The motor would spin an AC dynamo connected both to your house mains and to the utility lines.

Giacoletto fed numbers into his slide rule and came up with intriguing cost figures. An average house roof in Detroit would produce about 10,000 kilowatt-hours of usable AC per year (allowing for cloudy days and losses in solar cells, motor, and dynamo). That's three times as much as the average house con-

CONTINUED

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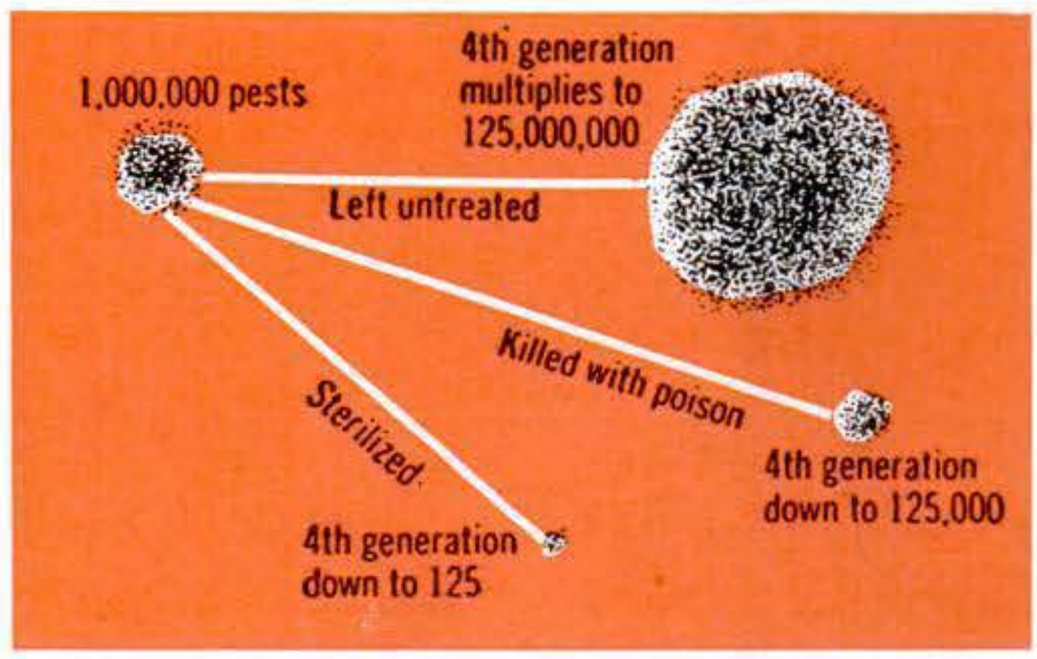
sumes per year. A motor-generator set for your cellar would cost less than $1,000, which is reasonable considering that it should last much longer than your furnace.

The joker is that roof. At present prices, the cost of roofing your house with ultra-pure silicon is "in the neighborhood of $250,000." A ritzy neighborhood. Don't give up hope, though. Remember what happened to another once-costly element, aluminum. Not too long ago it was so expensive it was used only for jewelry. Now the commercial metal—very, very pure—is indeed cheap enough to be a common roofing material.

Sex—the best pest-killer. Couple of years ago agricultural scientists rid the island of Curacao of screwworms—a costly nuisance to livestock—by a roundabout, highly unorthodox scheme. They released barrelsful of male screwworms that had been sexually sterilized (from exposure to atomic rays) but not otherwise harmed. Lady screwworms happily but fruitlessly mated with the sterile males, and soon screwworms were as extinct as saber-toothed tigers.

This dirty trick worked so well (a current trial in Florida is also paying off) that E. F. Knipling of the U. S. Department of Agriculture thinks it should be applied to other pests—not just bugs but mice, rats, and bigger animals. He figures that forcing racial suicide gets rid of the unwanted more quickly than simply killing them off.

Knipling cites a theoretical example of a million pests (see chart at left). Left alone, they'd multiply to 125 million by the fourth generation. Killed off by poison (90 percent effective) in the usual manner, the fourth generation would be down to 125,000. But if 90 percent of each generation were sterilized, the fourth generation would number just 125, period. The Curacao experiment checked out these calculations (the fourth generation of screwworms there was zero).



For sterilization to work this well, the pests have to cooperate. The females must be monogamous and the males sexually vigorous after sterilization (screwworms were very helpful; the females mate just once, while the males are completely promiscuous). You also have to kill off most of the pests first, then breed and release enough sterile males so that they outnumber the unsterilized ones nine to one. Better and easier would be a chemical that sterilized 90 percent of all the pests "in the field." Such a chemical hasn't been developed yet, but should be possible.

Success of the sterile-male method for total extinction also has its frightening aspects. Could what happened to screwworms in Curacao happen to people after a really hot atomic war?

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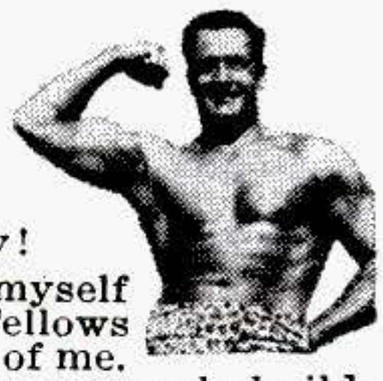

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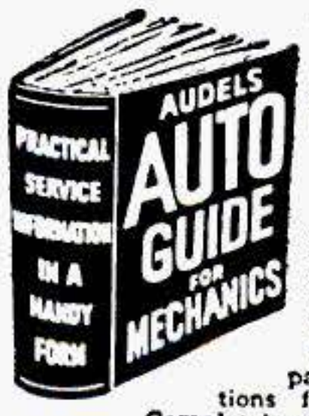

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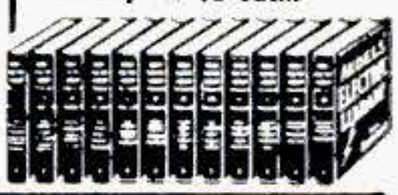

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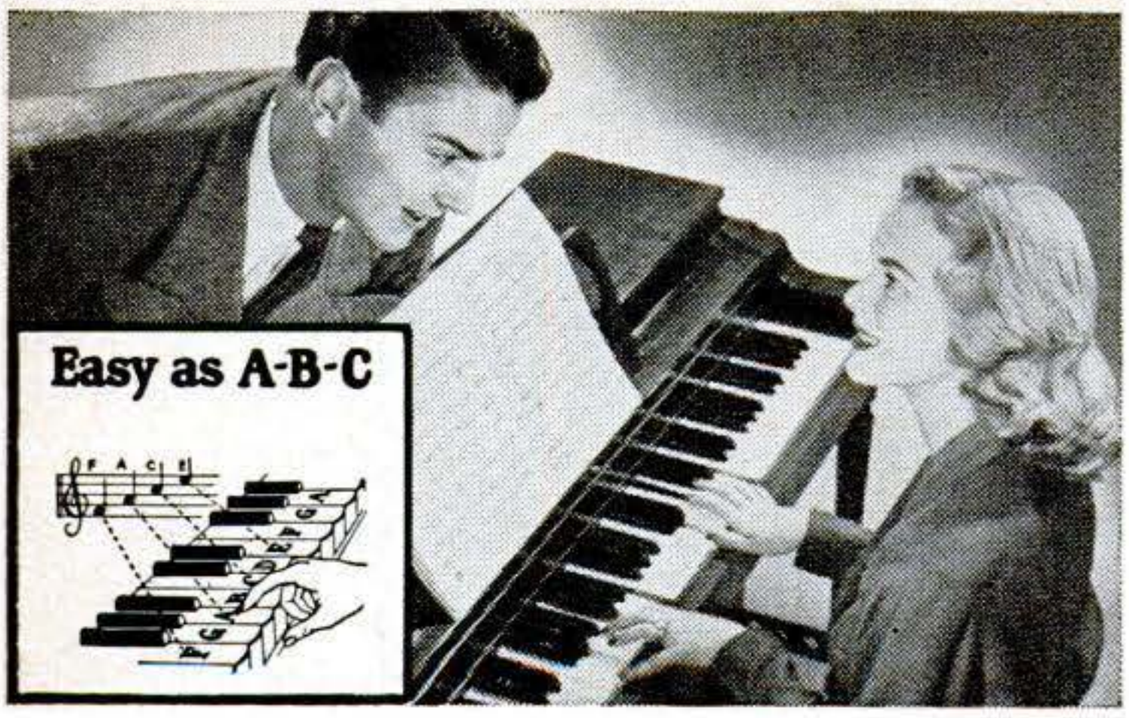

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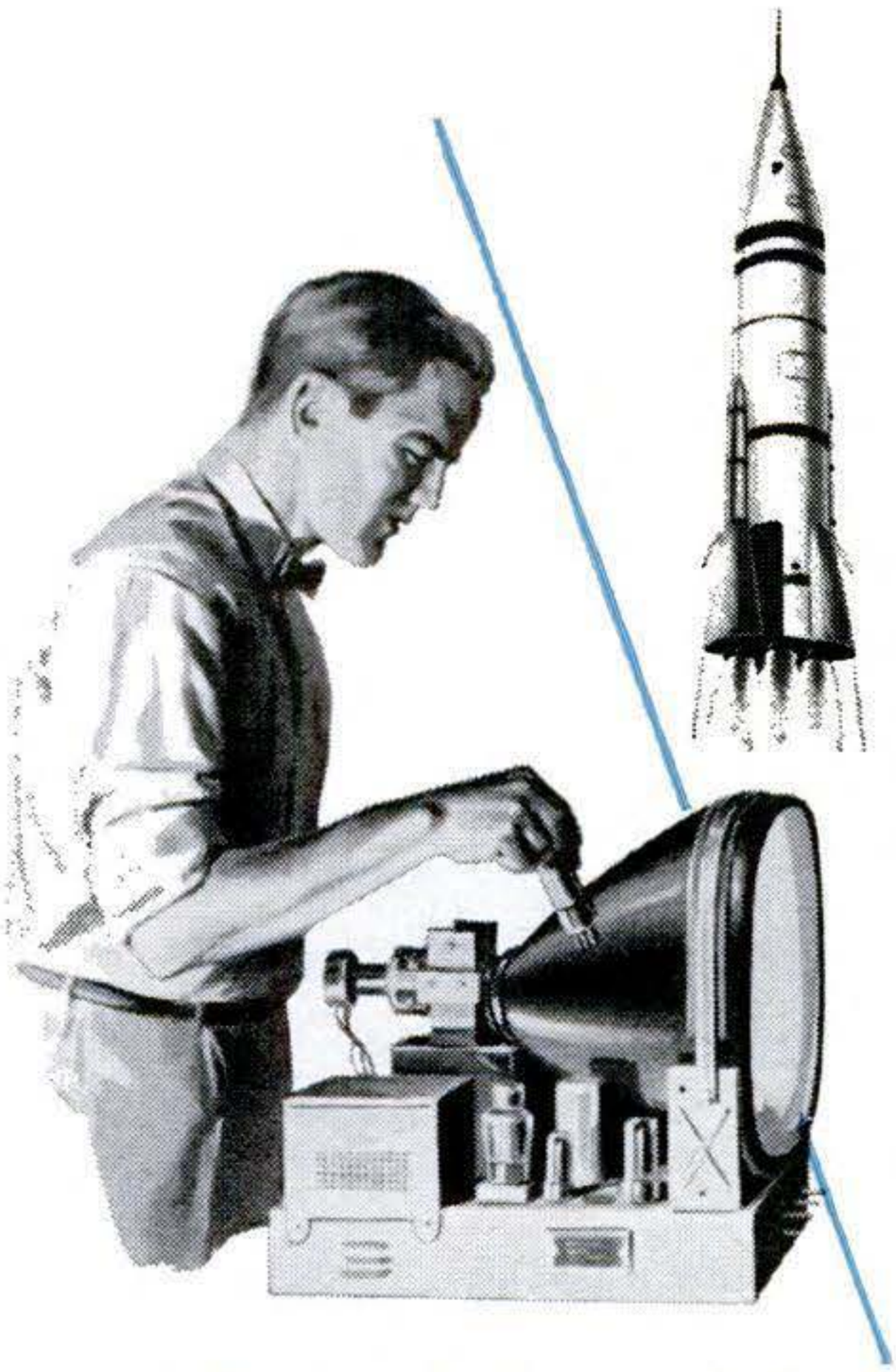

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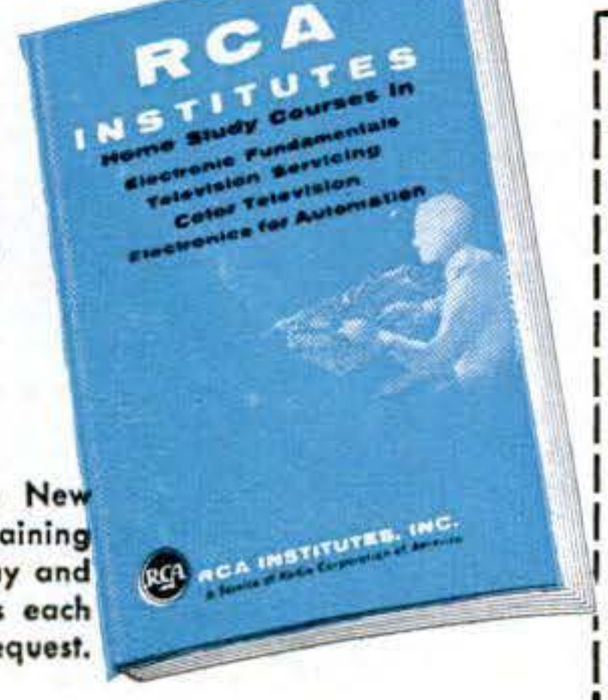

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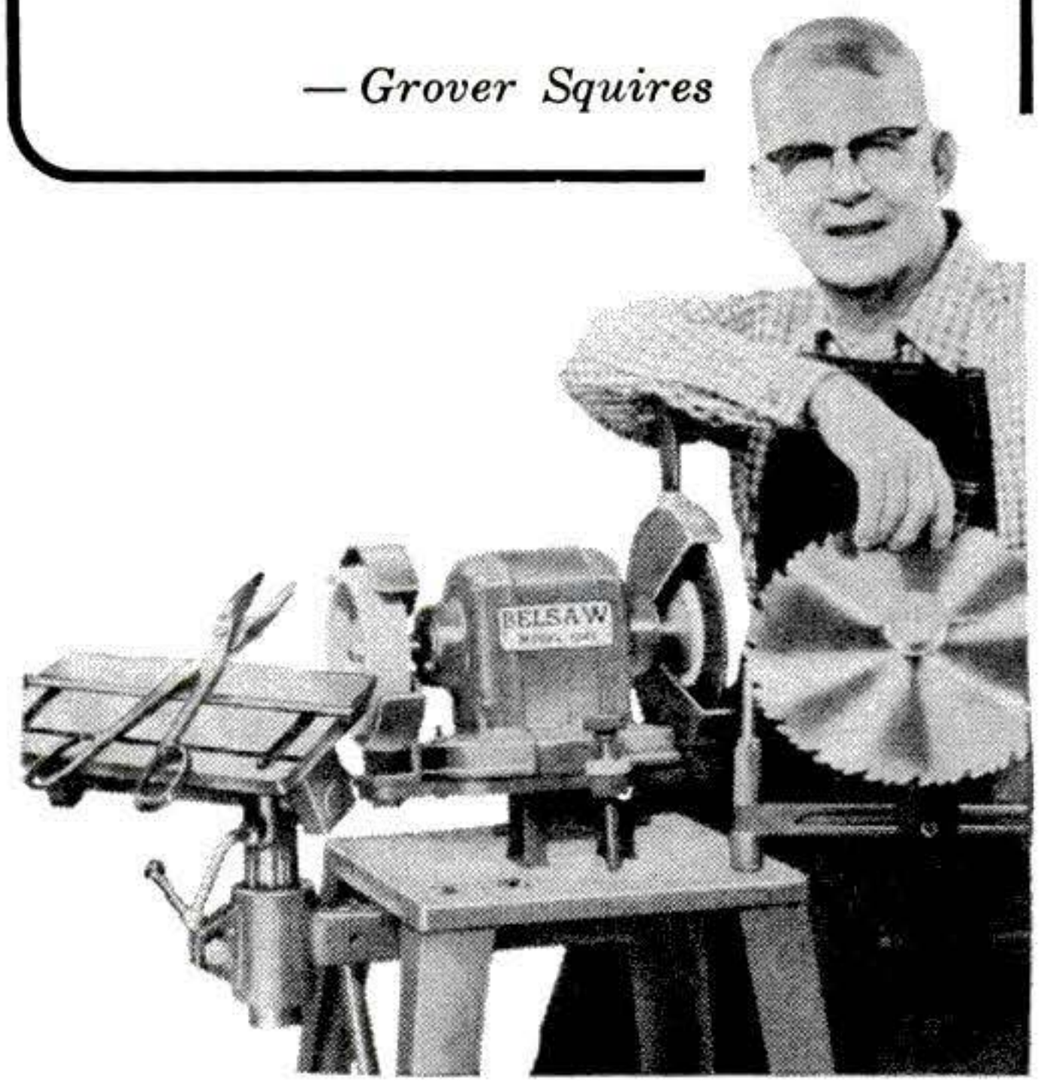

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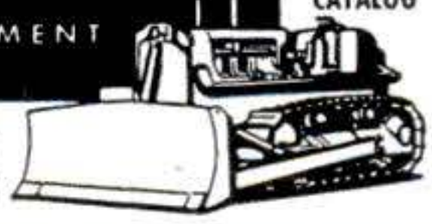

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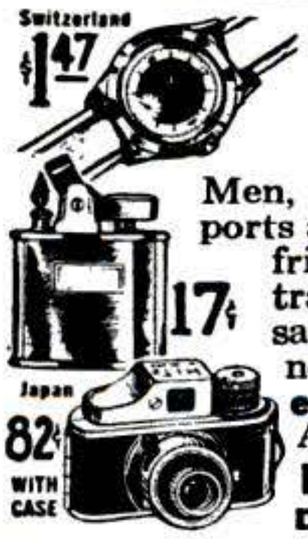

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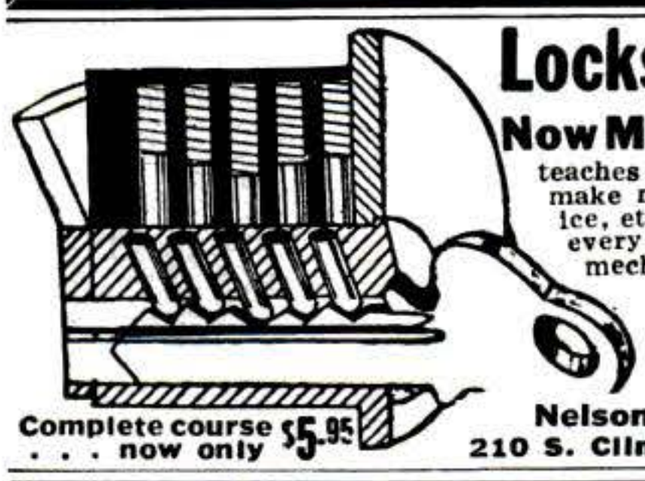

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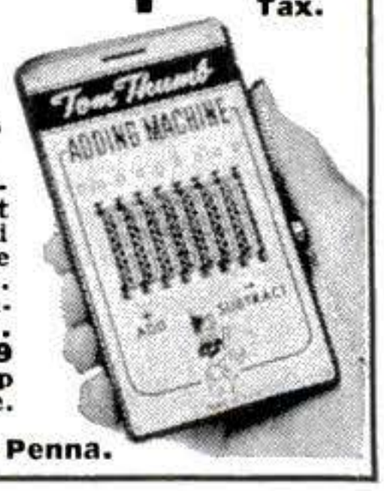

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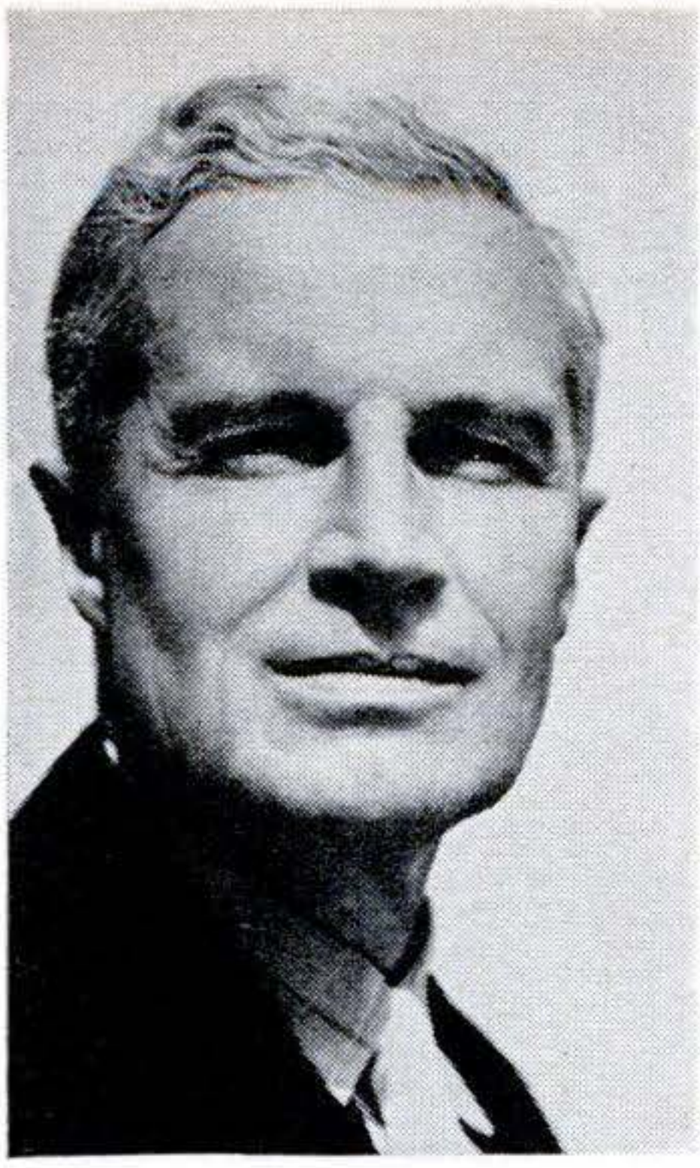

I'd like to give this to my fellow men...

while I am still able to help!

I was young once, as you may be—today I am older. Not too old to enjoy the fruits of my work, but older in the sense of being wiser. And once I was poor, desperately poor. Today almost any man can stretch his income to make ends meet. Today, there are few who hunger for bread and shelter. But in my youth I knew the pinch of poverty; the emptiness of hunger; the cold stare of the creditor who would not take excuses for money. Today, all that is past. And behind my city house, my summer home, my Cadillacs, my Winter-long vacations and my sense of independence—behind all the wealth of cash and deep inner satisfaction that I enjoy—there is one simple secret. It is this secret that I would like to impart to you. If you are satisfied with a humdrum life of service to another master, turn this page now—read no more. If you are interested in a fuller life, free from bosses, free from worries, free from fears, read further. This message may be meant for you.

By Victor B. Mason

I am printing my message in a magazine. It may come to the attention of thousands of eyes. But of all those thousands, only a few will have the vision to understand. Many may read; but of a thousand only you may have the intuition, the sensitivity, to understand that what I am writing may be intended for you—may be the tide that shapes your destiny, which, taken at the crest, carries you to levels of independence beyond the dreams of avarice.

Don't misunderstand me. There is no mysticism in this. I am not speaking of occult things; of innumerable laws of nature that will sweep you to success without effort on your part. That sort of talk is *rubbish!* And anyone who tries to tell you that you can *think* your way to riches without effort is a false friend. I am too much of a realist for that. And I hope you are.

I hope you are the kind of man—if you have read this far—who knows that anything worthwhile has to be *earned!* I hope you have learned that there is no reward without effort. If you have learned this, then you may be ready to take the next step in the development of your karma—you may be ready to learn and use the secret I have to impart.

I Have All The Money I Need

In my own life I have gone beyond the need of money. I have it. I have gone beyond the need of gain. I have two businesses that pay me an income well above any amount I have need for. And, in addition, I have the satisfaction—the deep satisfaction—of knowing that I have put more than three hundred other men in businesses of their own. Since I have no need for money, the greatest satisfaction I get from life, is sharing my secret of personal independence with others—seeing them achieve the same heights of happiness that have come into my own life.

Please don't misunderstand this statement. I am not a philanthropist. I believe that charity is something that no proud man will accept. I have never seen a man who was worth his salt who would accept something for nothing. I have never met a highly successful man whom the world respected who did not sacrifice something to gain his position. And, unless you are willing to make at least half the effort, I'm not interested in giving you a "leg up" to the achievement of your goal. Frankly, I'm going to charge you something for the secret I give you. Not a lot—but enough to make me believe that you are a little above the fellows who merely "wish" for success and are not willing to sacrifice something to get it.

A Fascinating and Peculiar Business

I have a business that is peculiar—one of my businesses. The unusual thing about it is that it is needed in every little community throughout this country. But it is a business that will never be invaded by the "big fellows". It has to be handled on a local basis. No giant octopus can ever gobble up the whole thing. No big combine is ever going to destroy it. It is essentially a "one man" business that can be operated without outside help. It is a business that is good summer and winter. It is a business that is growing each year. And, it is a business that can be started on an investment so small that it is within the reach of anyone who has a television set. But it has nothing to do with television.

This business has another peculiarity. It can be started at home in spare time. No risk to present job. No risk to present income. And no need to let anyone else know you are "on your own". It can be run as a spare time business for extra money. Or, as it grows to the point where it is paying more than your present salary, it can be expanded into a full time business—overnight. It can give you a sense of personal independence that will free you forever from the fear of lay-off, loss of job, depressions, or economic reverses.

Are You Mechanically Inclined?

While the operation of this business is partly automatic, it won't run itself. If you are to use it as a stepping stone to independence, you must be able to work with your hands, use such tools as hammer and screw driver, and enjoy getting into a pair of blue jeans and rolling up your sleeves. But two hours a day of manual work will keep your "factory" running 24 hours turning out a product that has a steady and ready sale in every community. A half dollar spent for raw materials can bring you six dollars in cash—six times a day.

In this message I'm not going to try to tell you the entire story. There is not enough space on this page. And, I am not going to ask you to spend a penny now to learn the secret. I'll send you all the information, free. If you are interested in becoming independent, in becoming your own boss, in knowing the sweet fruits of success as I know them, send me your name. That's all. Just your name. I won't ask you for a penny. I'll send you all the information about one of the most fascinating businesses you can imagine. With these facts, you will make your own investigation. You will check up on conditions in your neighborhood. You will weigh and analyze the whole proposition. Then, and then only, if you decide to take the next step, I'll allow you to invest $15.00. And even then, if you decide that your fifteen dollars has been badly invested I'll return it to you. Don't hesitate to send your name. I have no salesmen. I will merely write you a long letter and send you complete facts about the business I have found to be so successful. After that, you make the decisions.

Does Happiness Hang on Your Decision?

Don't put this off. It may be a coincidence that you are reading these words right now. Or, it may be a matter that is more deeply connected with your destiny than either of us can say. There is only one thing certain: If you have read this far you are interested in the kind of independence I enjoy. And if that is true, then you must take the next step. No coupon on this advertisement. If you don't think enough of your future happiness and prosperity to write your name on a postcard and mail it to me, forget the whole thing. But if you think there is a destiny that shapes men's lives, send your name now. What I send you may convince you of the truth of this proverb. And what I send you will not cost a penny, now or at any other time.

VICTOR B. MASON
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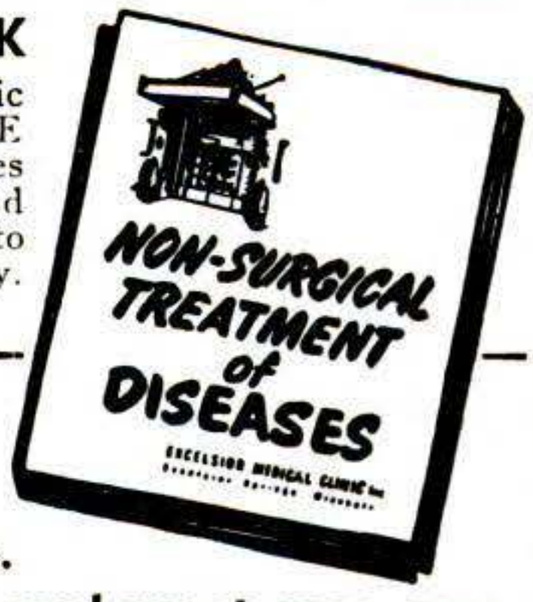

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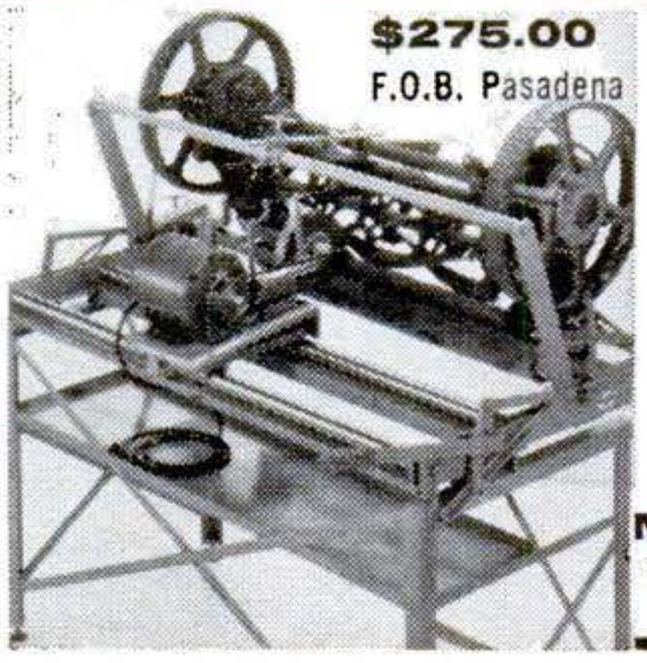

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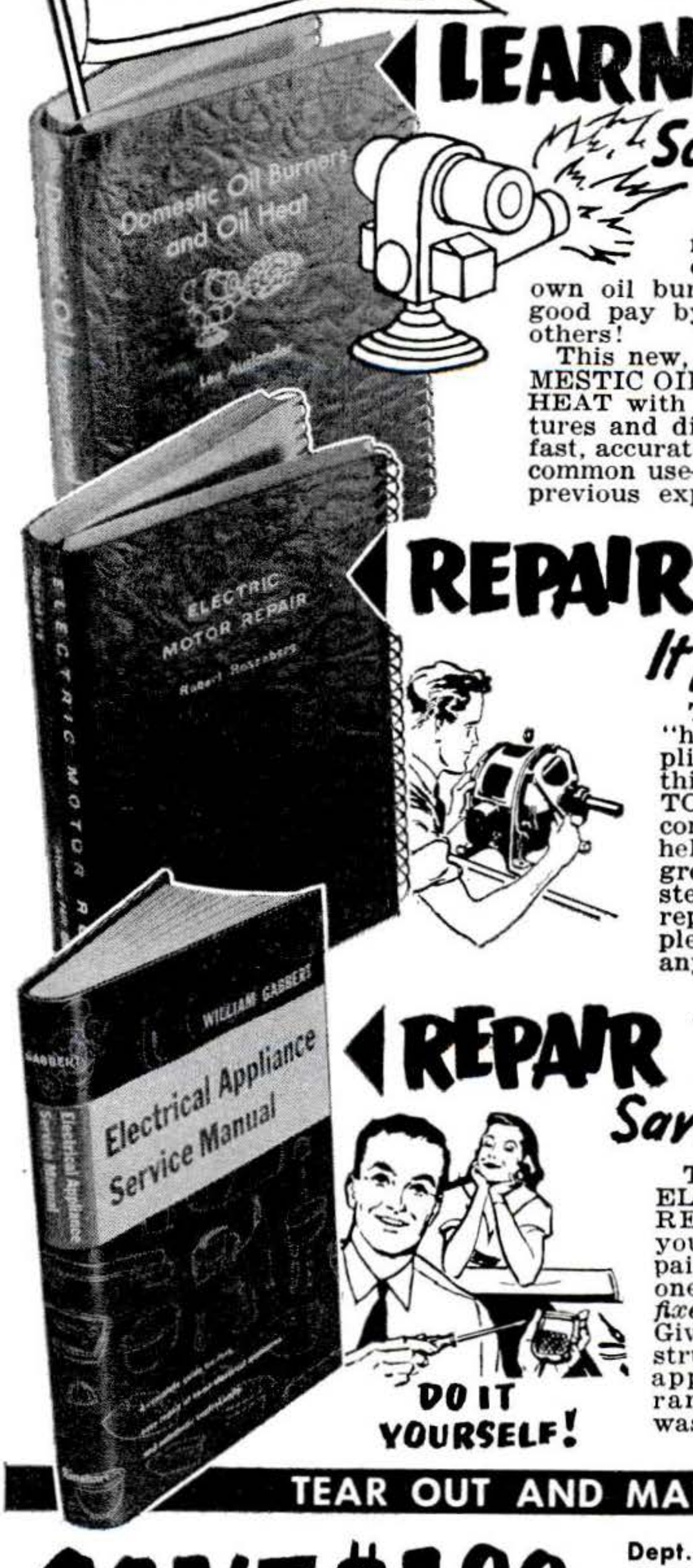

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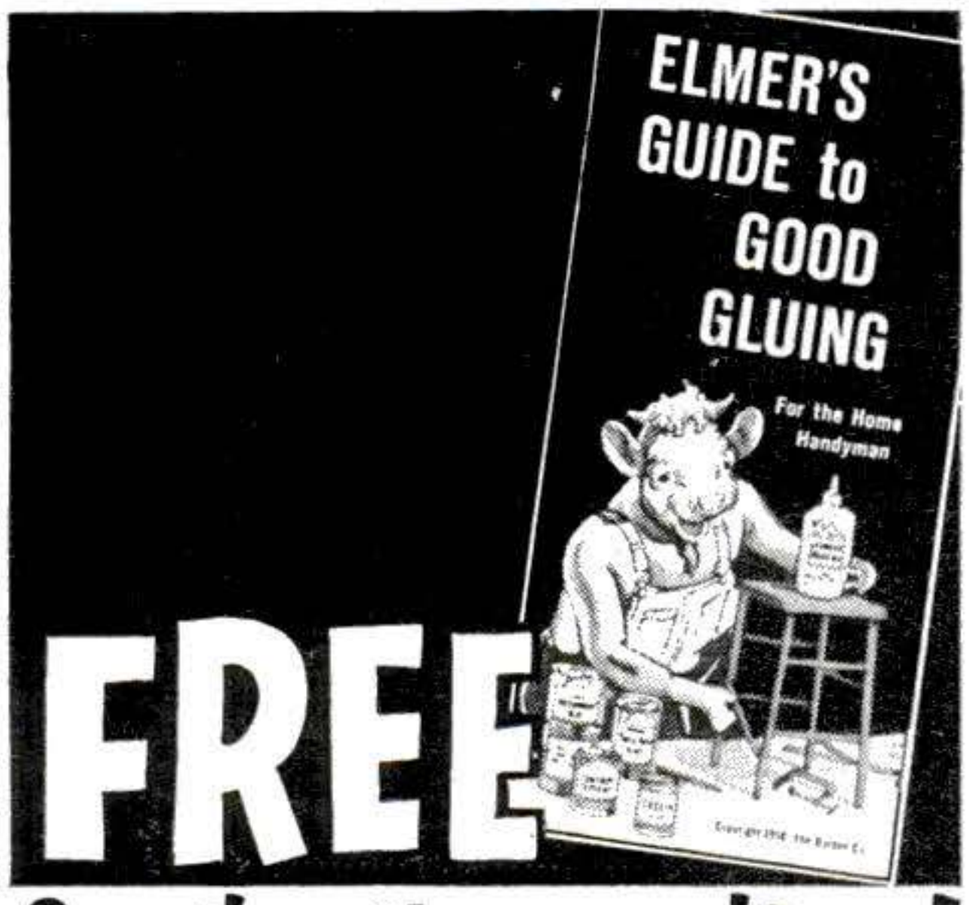

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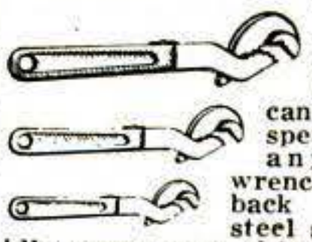

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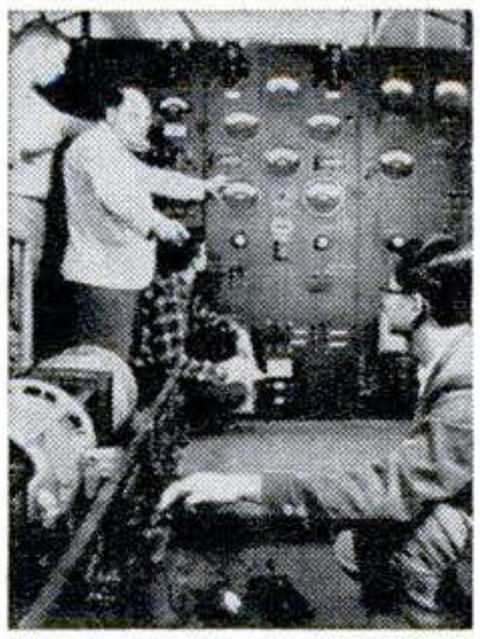

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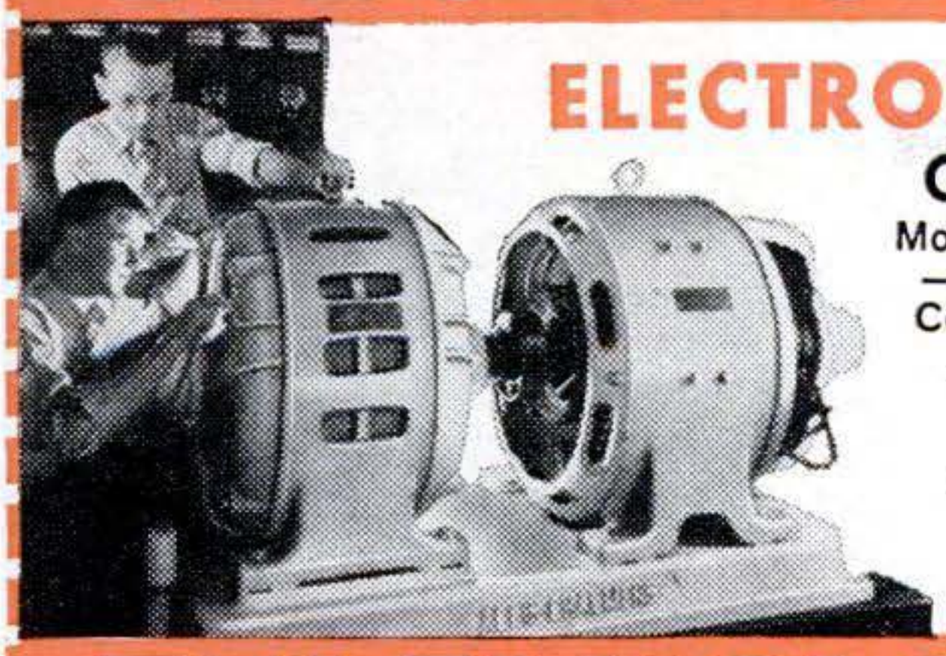

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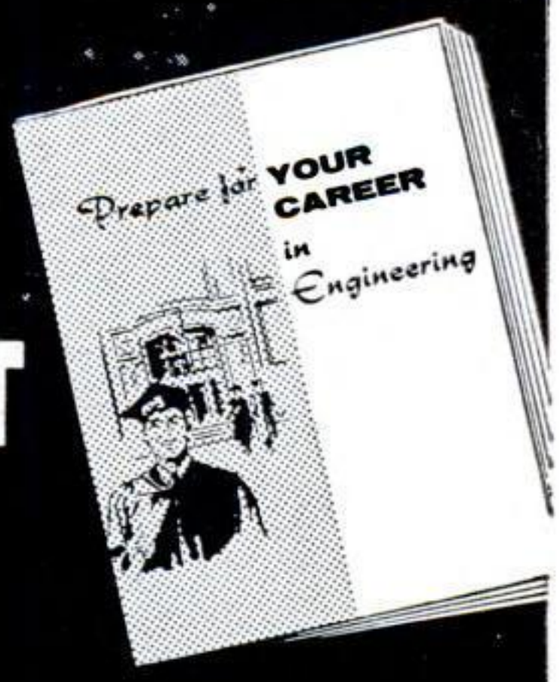

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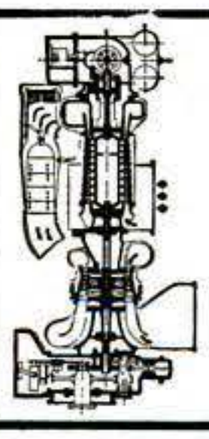

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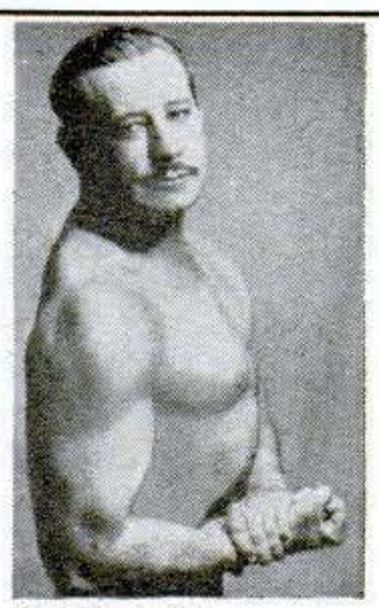

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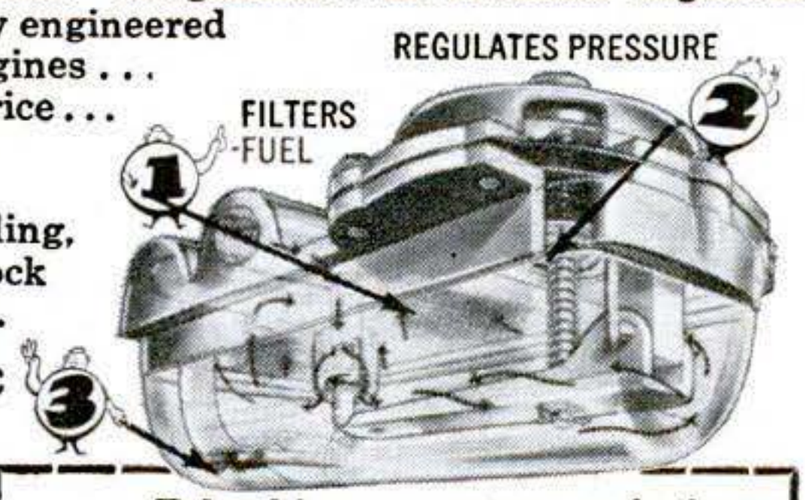

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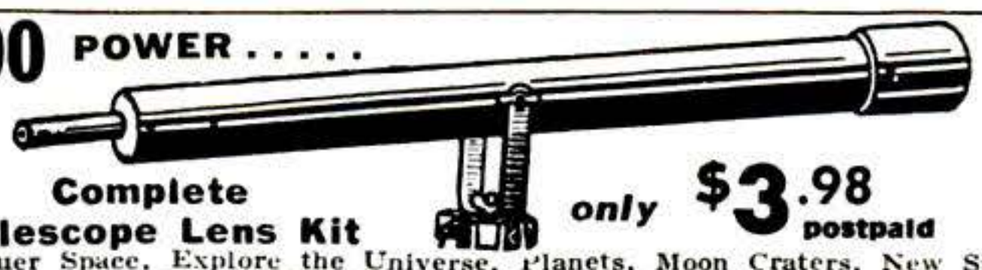

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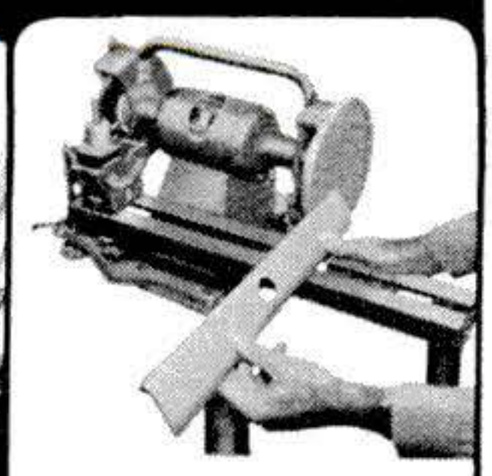

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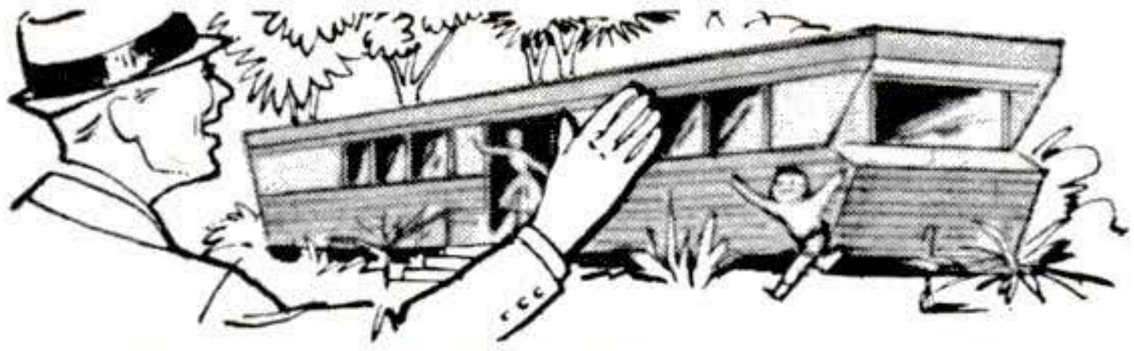

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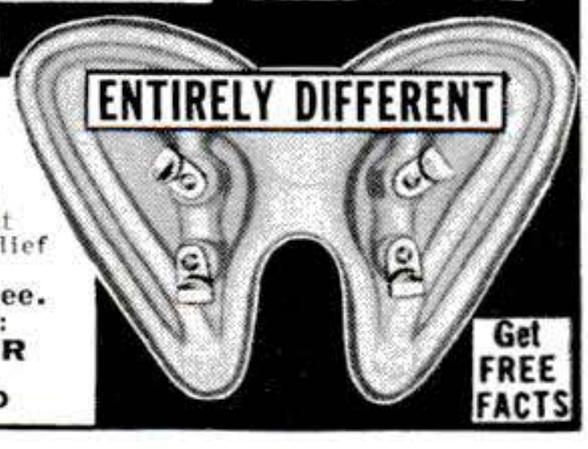

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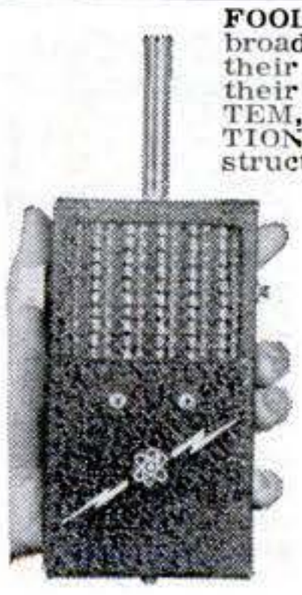

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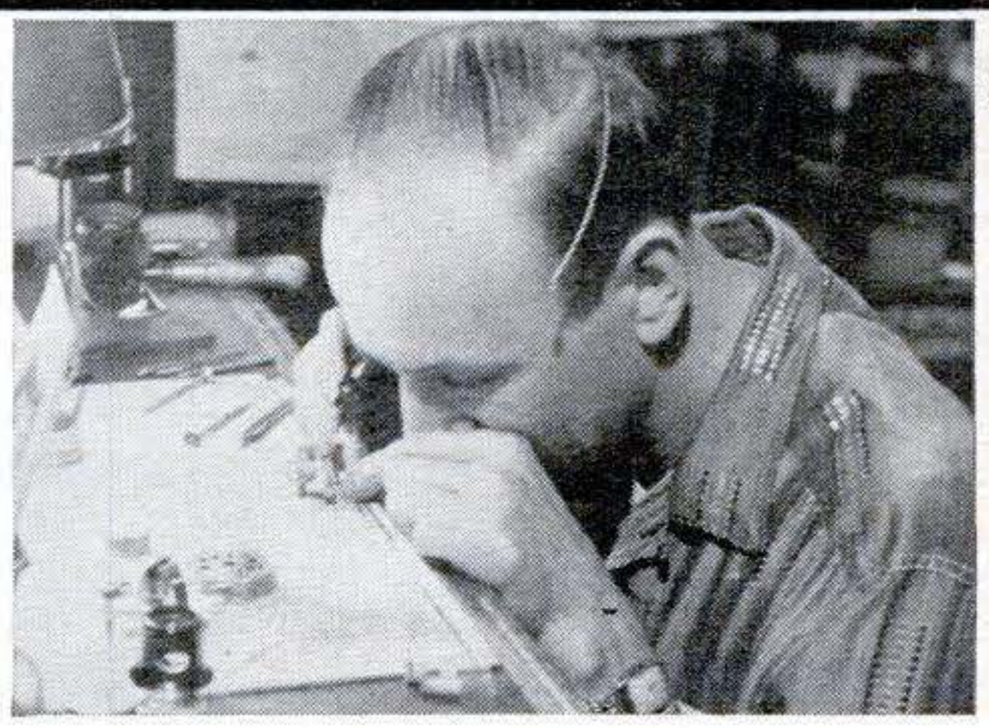

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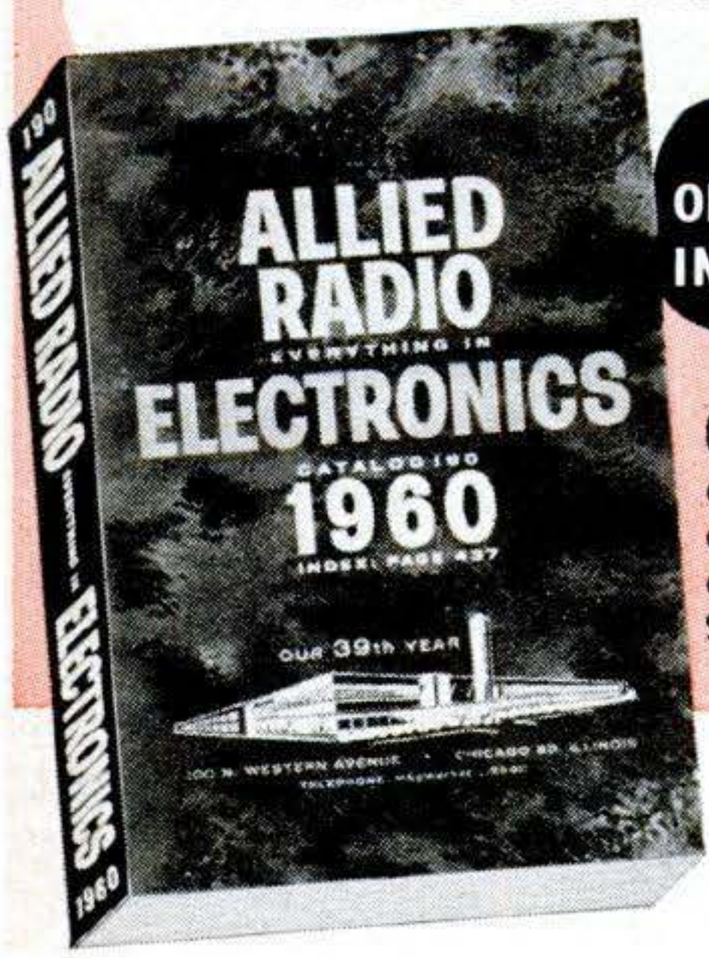

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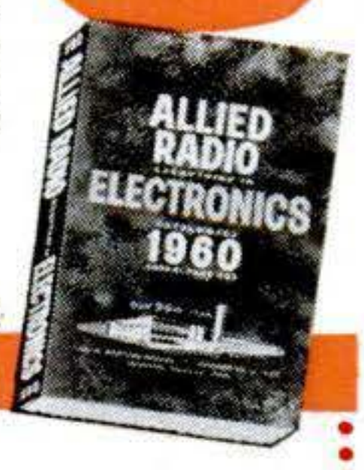

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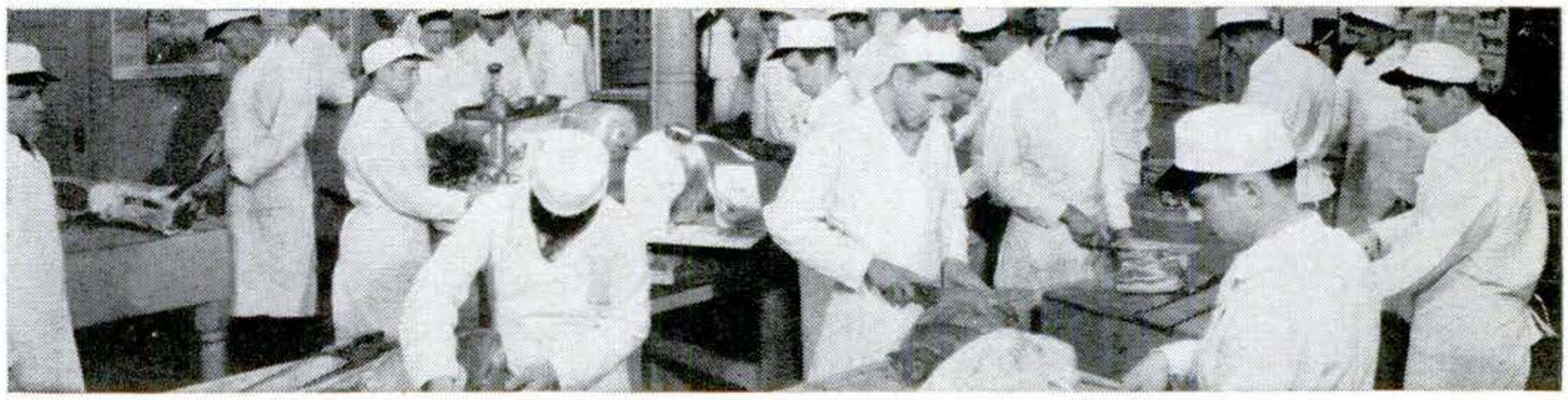

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In this issue, Classified Advertising Starts On Page 260

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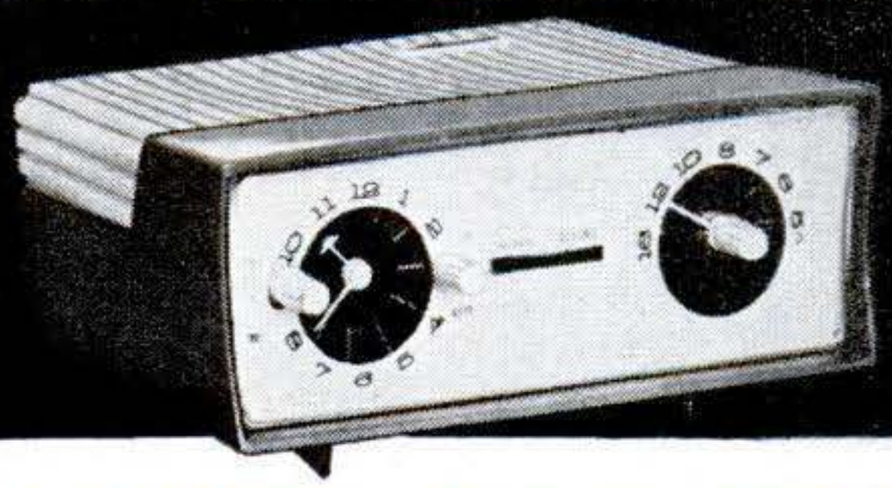

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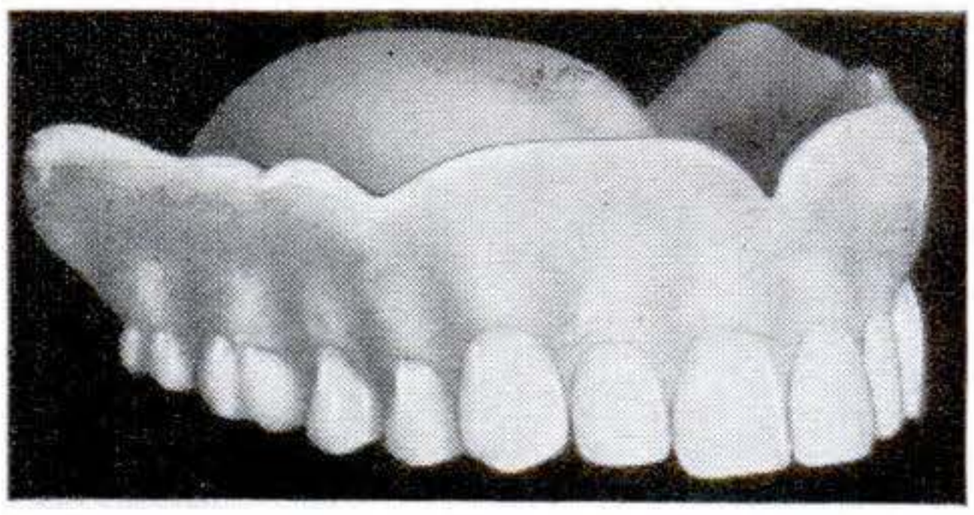

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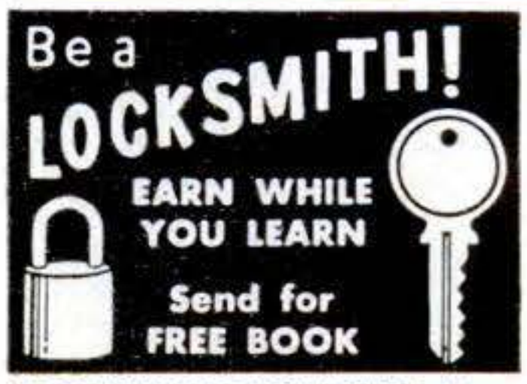

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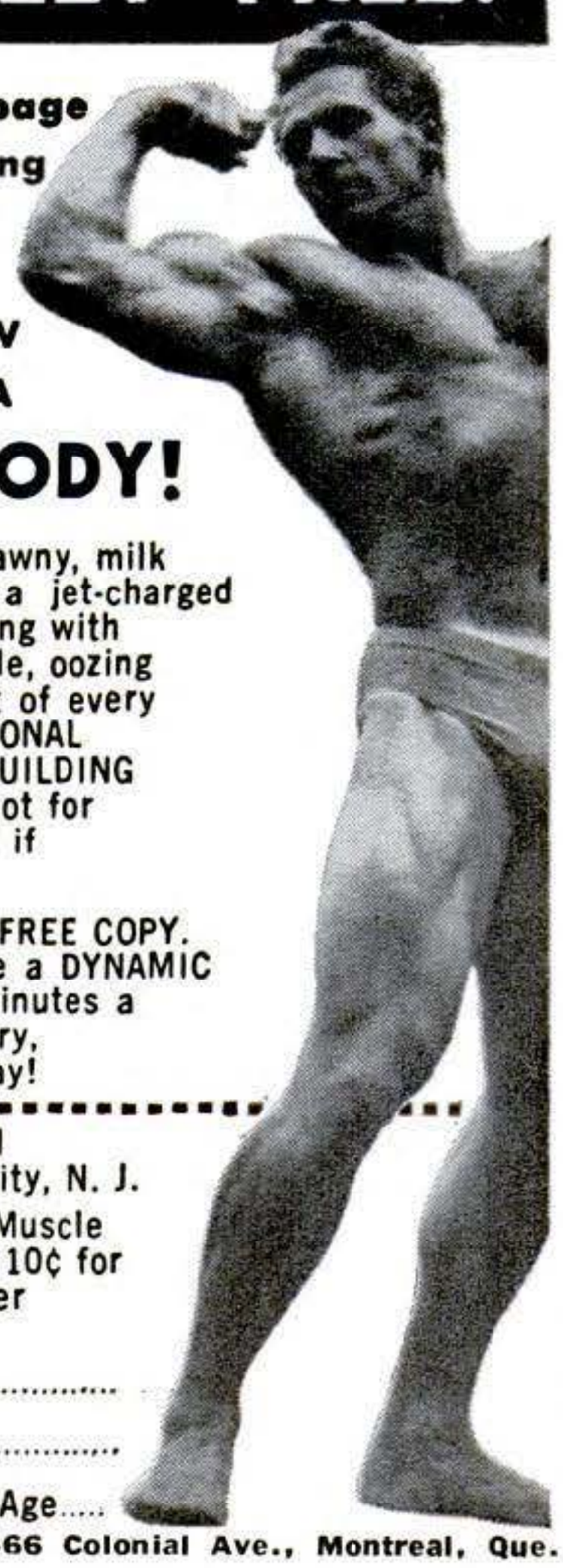

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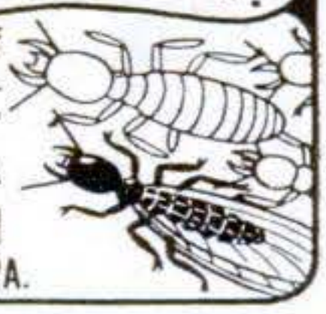

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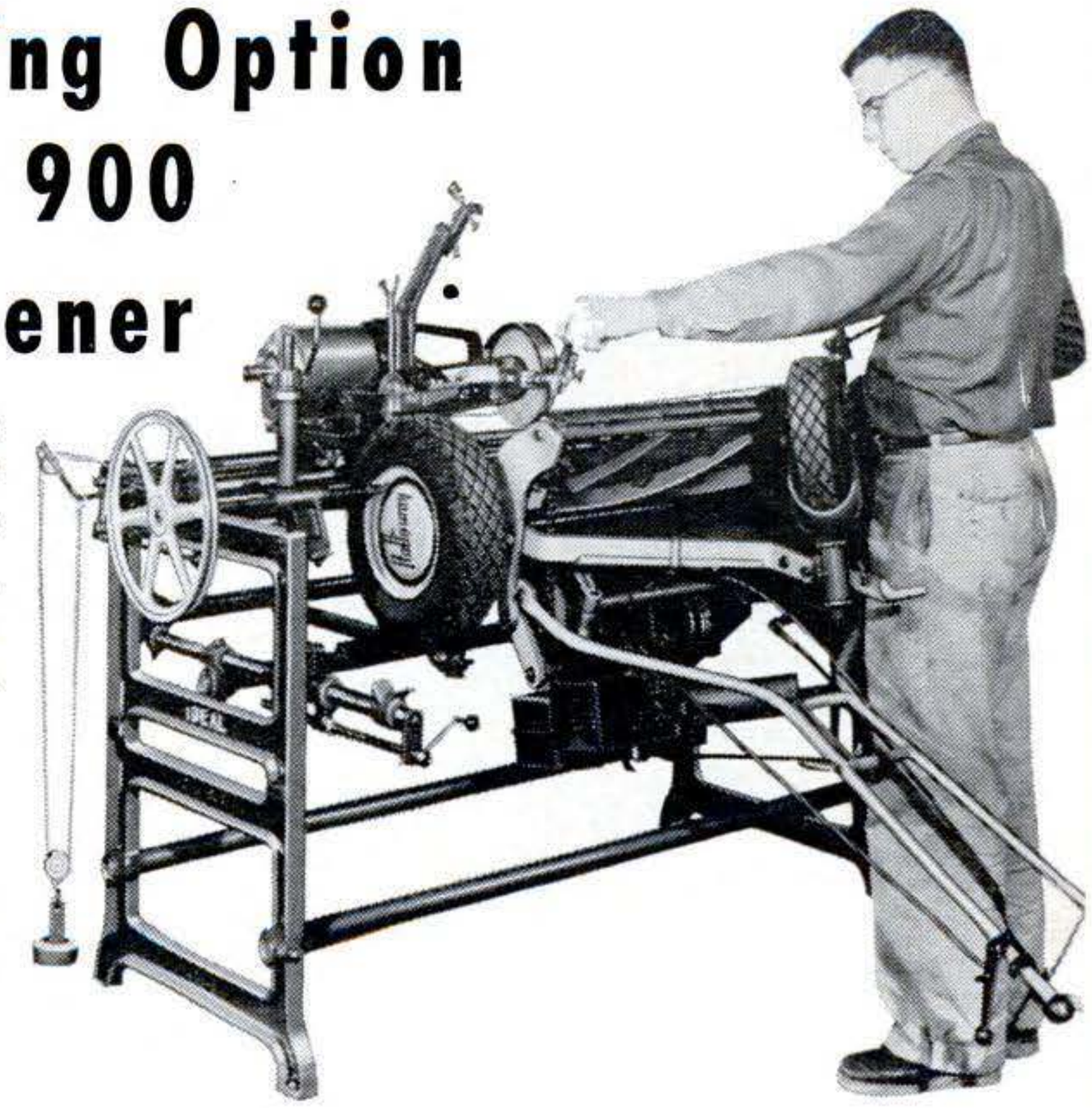

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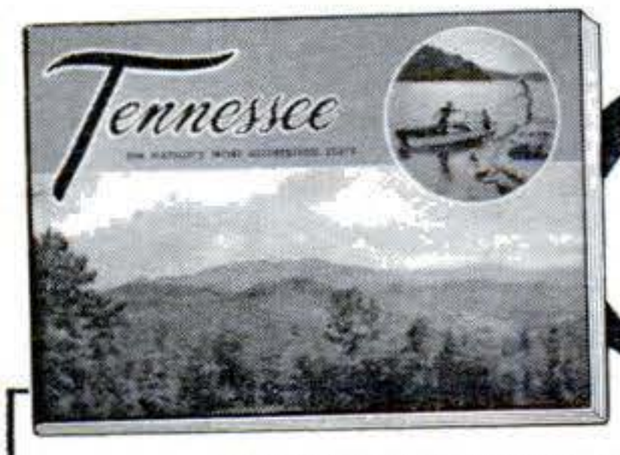

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DETROIT REPORT

By Ken Fermoyle *PS Detroit Editor*

Smog Relief? Next Year, Maybe

Smog control around the corner? Devices to absorb automobile exhausts are on the way but, news headlines to the contrary, they probably won't be available for at least a year.

Southern Californians—who suffer most vocally from smog—recently were told of a "dramatic breakthrough" in the control of automobile exhaust fumes. The device, an exhaust manifold afterburner developed jointly by Chrysler Corp. and Thompson Ramo Wooldridge, Inc., was cited in terms that made it sound like a proven panacea. Anticipated price was quoted at about $125 for V-8s and less than $100 for sixes. The result was a hue and cry for a California state law to make anti-smog devices required equipment for all cars, starting with 1961 models.

The facts:

The Chrysler-TRW device shows "great promise," according to officials of both companies. More testing and development needs to be done. The afterburner so far is strictly in the prototype stage and has not been tested in vehicles on the road. There is no assurance that it can be sold for $125 or less. Much cost-engineering work remains before a firm price can be fixed.

Other auto companies and accessory manufacturers have had exhaust-control projects under way for some time, too. Some are studying various types of afterburners; others are working on catalytic mufflers. A few of these programs are almost as advanced as the Chrysler-TRW project, although Chrysler feels it is closest to the right track. It should know, too, because the entire anti-smog campaign is being handled on a very cooperative basis by the industry.

Meanwhile, barring a sudden breakthrough in smogless exhausts, a much simpler device to control crankcase-vapor pollution will be ready first. Californians should be able to buy them on 1961 American cars. Simple piping and valves feed "blowby"—unburned gasoline fumes—from the crankcase back to the cylinders. There it's burned instead of being vented to the outside where, scientists discovered recently, it's a substantial part of vehicle emissions.

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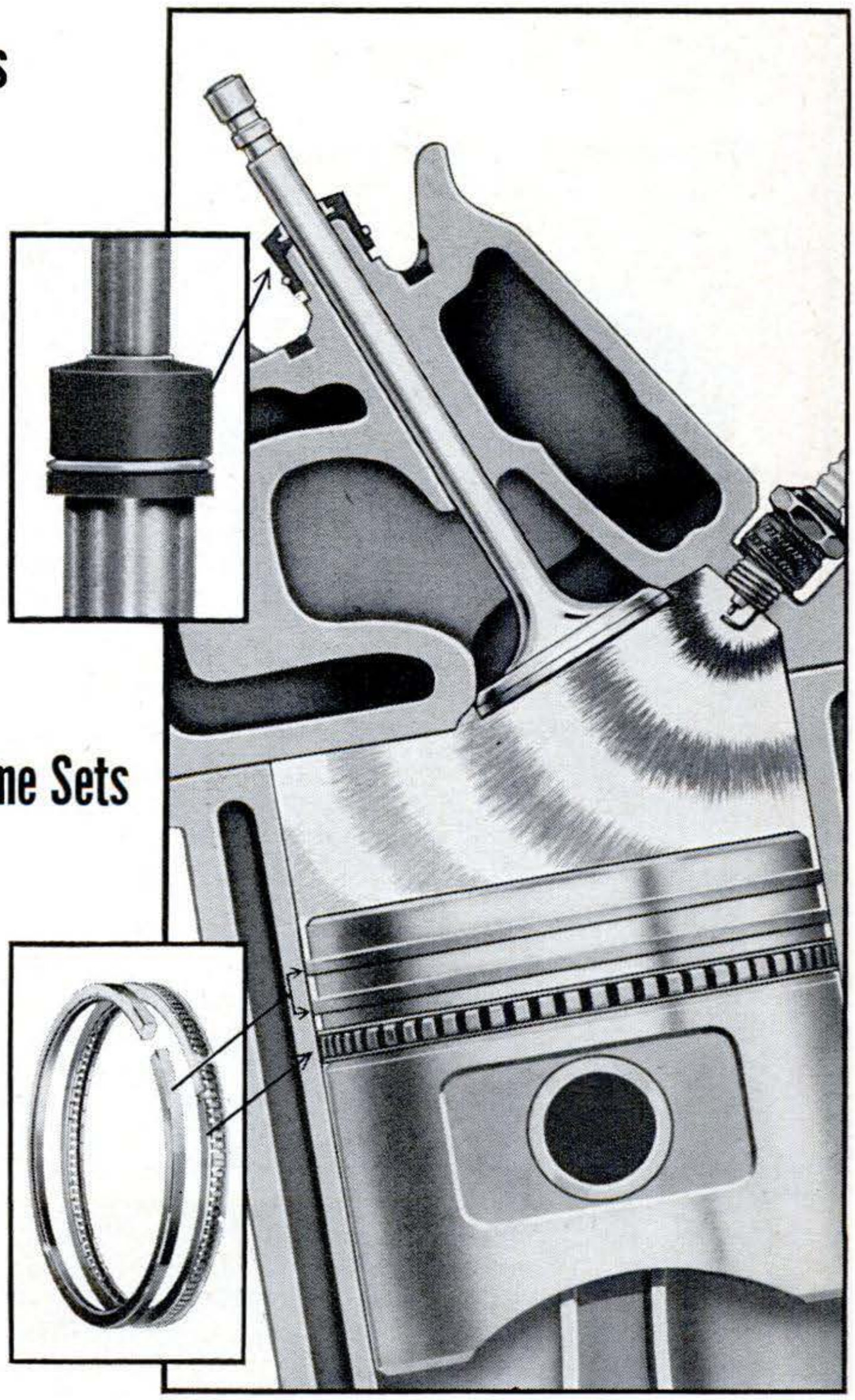

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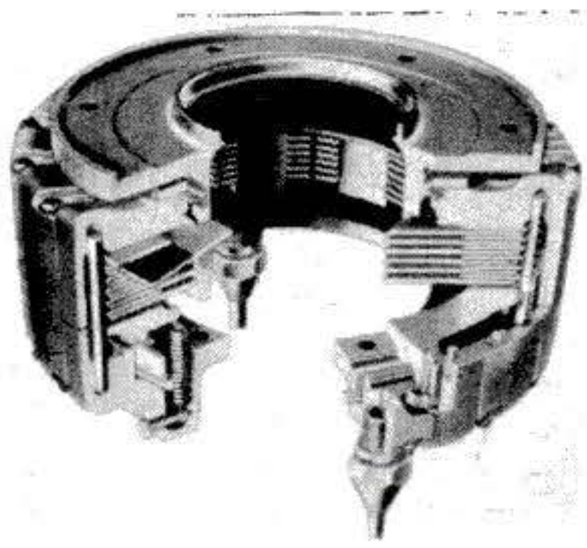
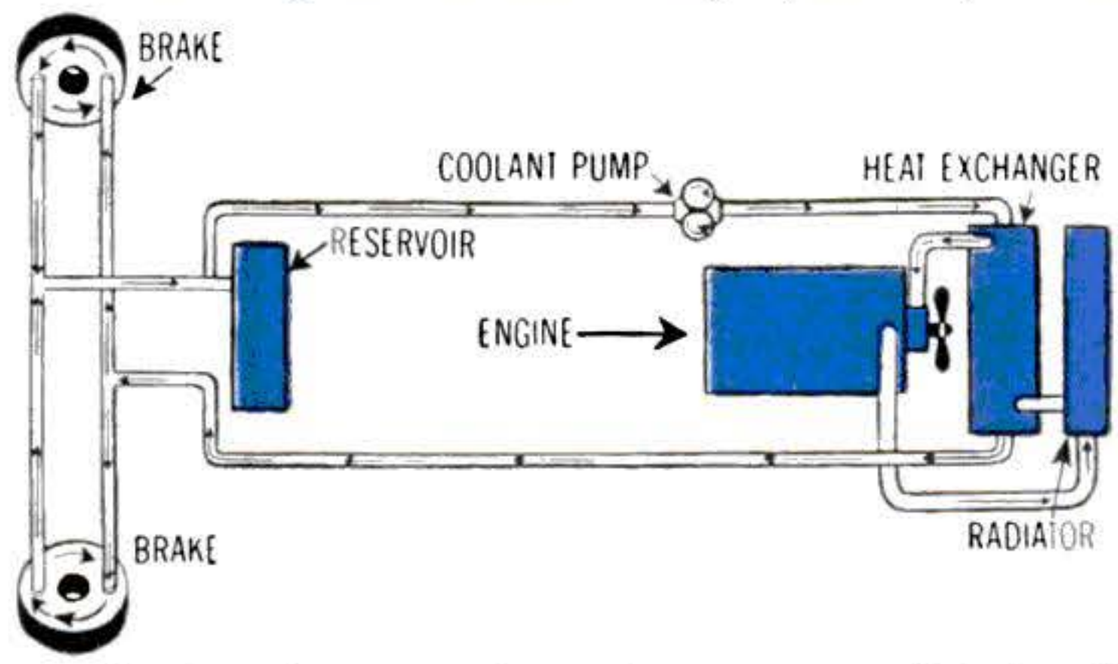
The rub? The process so far has been released only to Chevy dealers for reconditioning used cars.

Oil cools new truck brakes. Get oil in normal brakes and you're in trouble, but a new brake-retarder for trucks is filled with oil all the time—to get rid of fade-causing heat. The Auto Specialties Manufacturing Co. of St. Joseph, Mich., builder



Oil-cooled brake.



of disk brakes and clutches, makes the new multiple-disk brakes. They have sintered-metal linings that will last up to 300,000 miles, says the company. The brakes are lighter than standard air brakes and require little maintenance because an automatic adjuster compensates for lining wear.

Besides normal braking service, the new brakes can be used to retard speed on steep downgrades. The company reports that a series of 10 test stops, which left a conventional drum-braked truck without adequate stopping power due to excessive fade, produced absolutely no fade in a similar truck with the new oil-filled disk brakes.

A Rambler convertible for 1961. This is part of American Motors' program to keep sales momentum rolling in the face of Big Three compact-car competition. Also, the English-built Metropolitan line may be expanded to include more models—like station wagons and two-door sedans. Some engineering changes for the Metro might also be on the way. This finding and filling of chinks in the market left by the Big Three is an American Motors specialty.

Compact trucks coming. Look for scaled-down truck versions of some of the new compact cars. Ford will offer a Falcon pickup truck, probably late this spring, and reportedly has a panel delivery model on the drawing boards. Chevy is considering a light truck using the air-cooled Corvair engine. If it appears, it will be boxy, not unlike the VW trucks.

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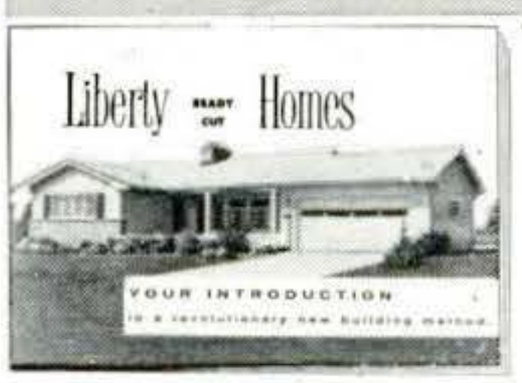

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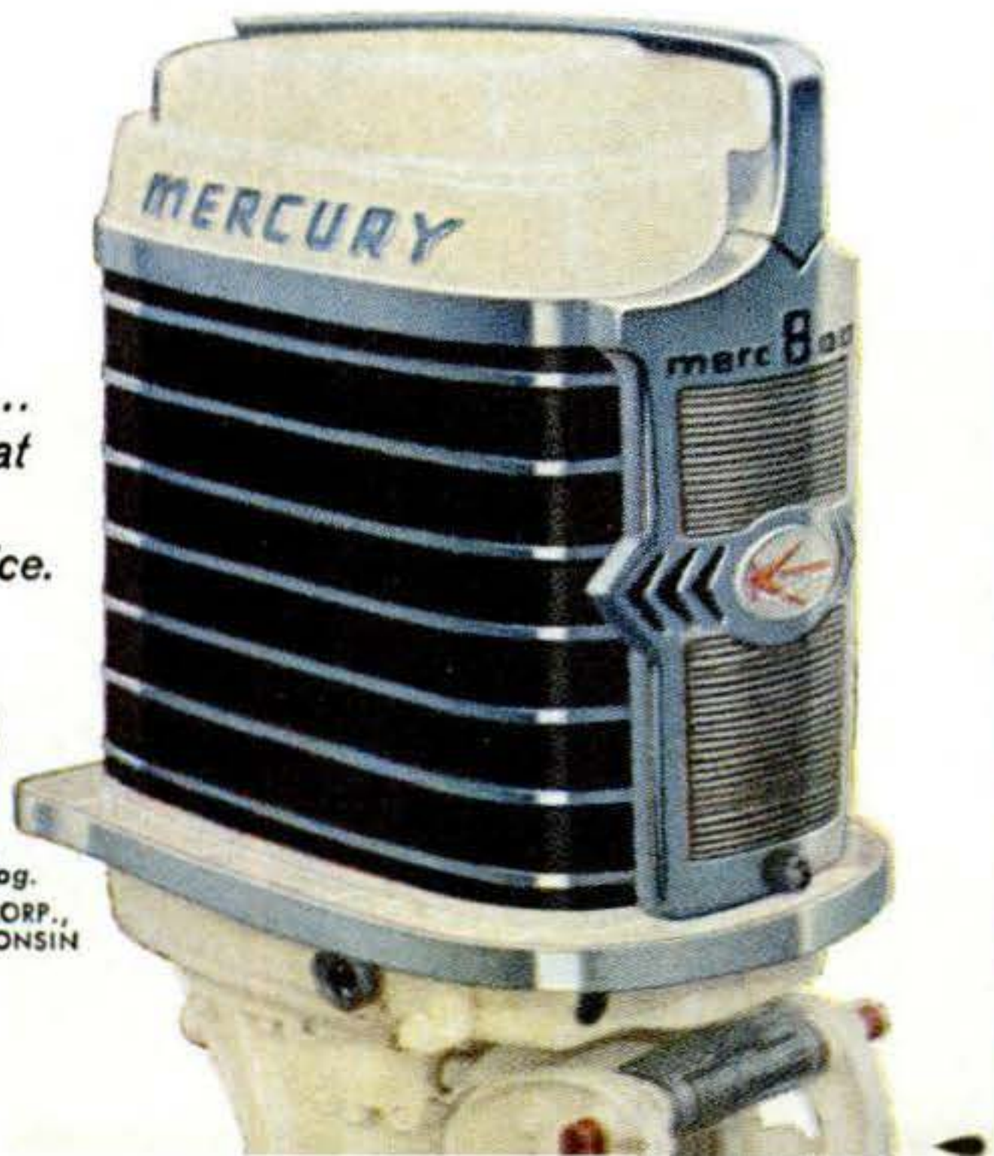

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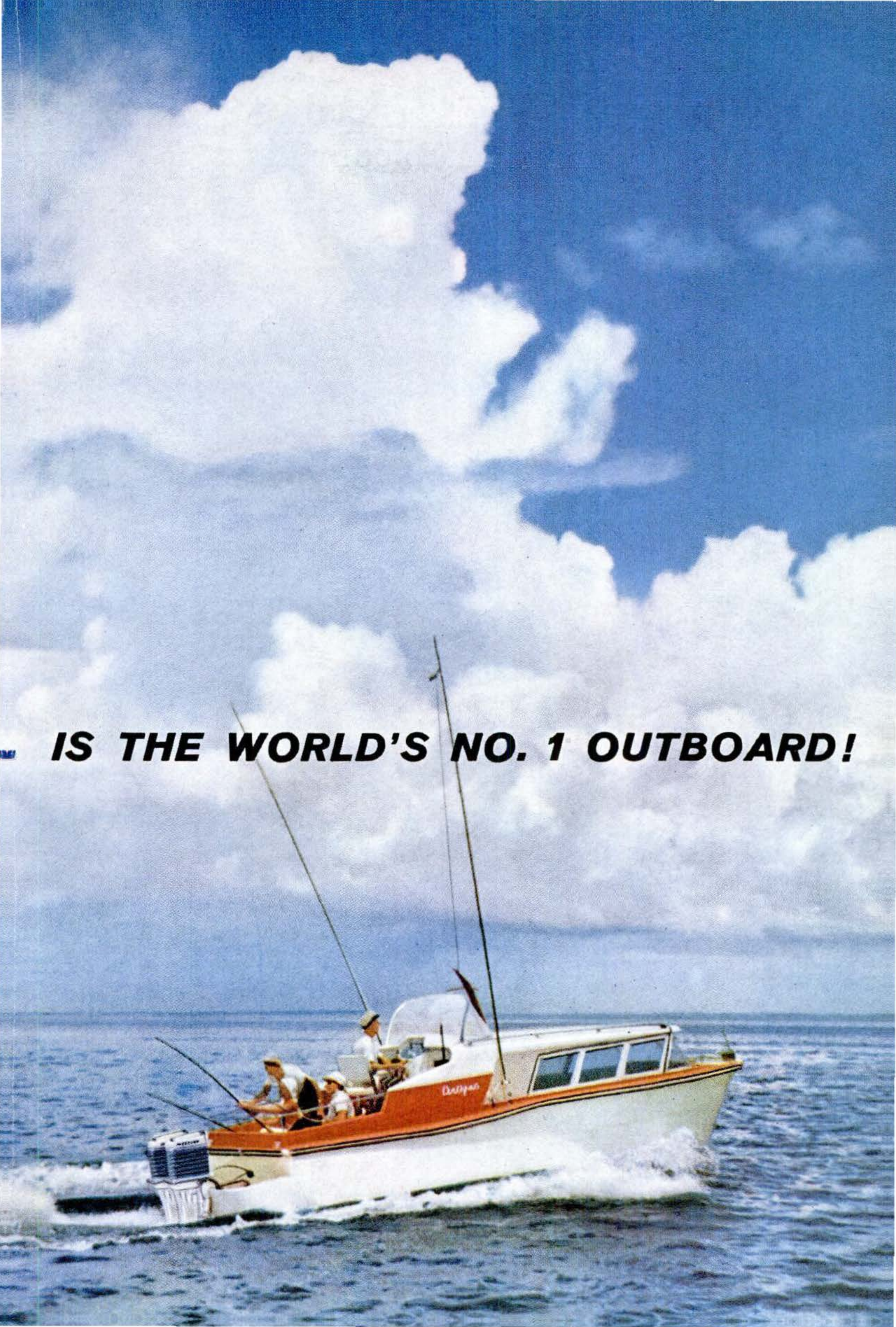
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See how Pall Mall's famous length of fine, rich-tasting tobacco travels and gentles the smoke—makes it mild—but does not filter out that satisfying flavor!

HERE'S WHY SMOKE "TRAVELED" THROUGH FINE TOBACCO TASTES BEST

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POPULAR SCIENCE
REG. U. S. PAT. OFF. Monthly

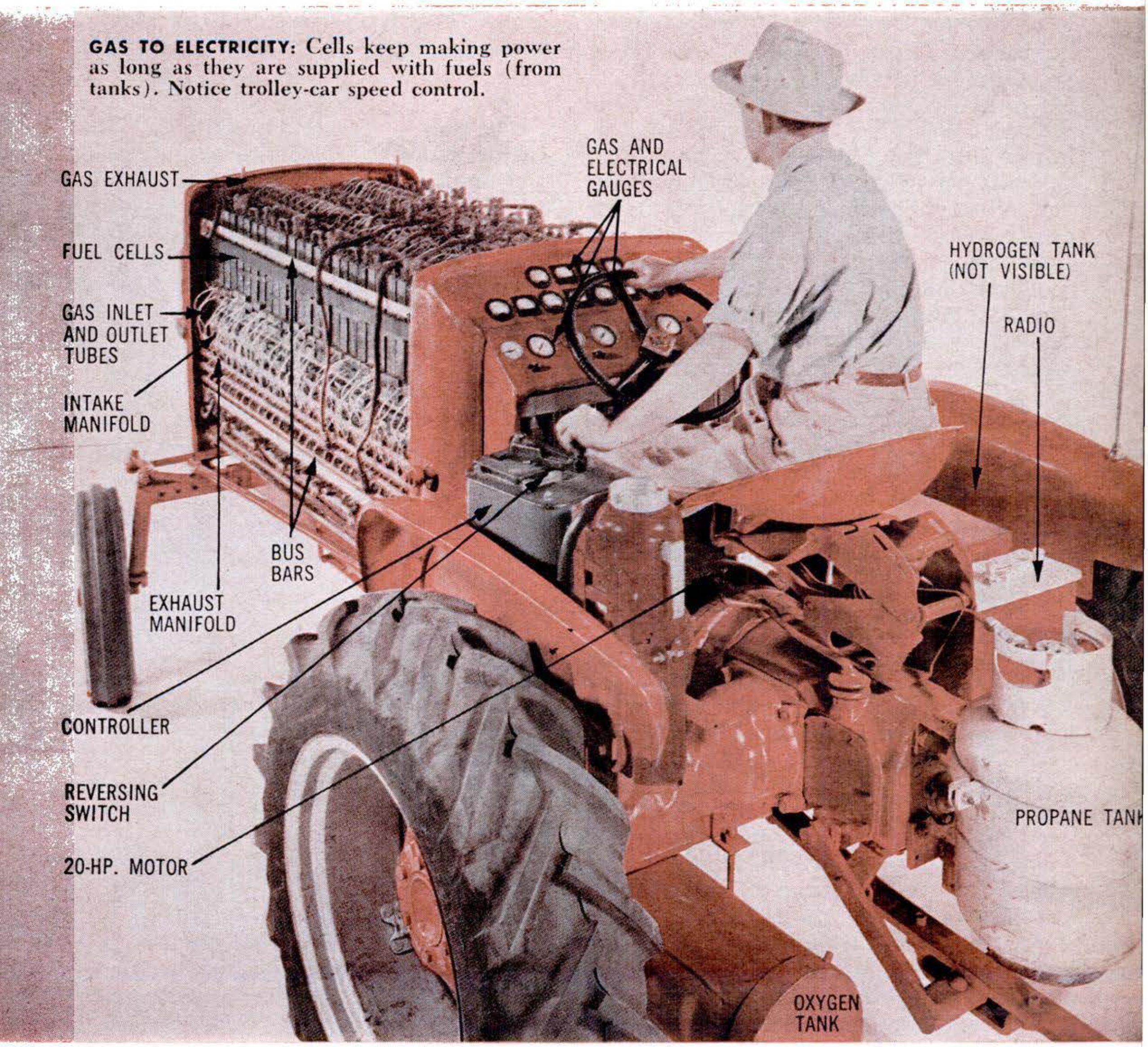
Electric cars coming? Cheap electricity from fuel cells may make them practical

Electric Tractor Makes Its Own Juice

By Martin Mann

THE bright orange tractor plowed Wisconsin loam while its driver listened to the radio. That was what struck you first—the radio. Many farm tractors make so much noise you'd never hear a radio. But this machine was eerily silent. If you listened closely, there was the discreet whine of an electric motor.

This was an electric tractor, all right. Under its hood were superefficient batteries, a strange new kind that never



GAS TO ELECTRICITY: Cells keep making power as long as they are supplied with fuels (from tanks). Notice trolley-car speed control.

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Under this hood there's nothing but fuel cells

FLEXING ITS MUSCLE— 3,000 lb. at drawbar—electric tractor pulls multiple-bottom plow through hard, dry earth. Tractor was a stunt, but factory trucks will be built for sale.

burns out. They are putting electric transport back on its wheels: A factory truck is in the works now, and electric cars, after a generation in the engineering attic, suddenly look very, very appealing.

But that's not all. The whole business of making and using electricity is in for a shakeup. These batteries are man-size power in small packages. They're ideal for any job off the power lines: camp sites, military outposts, space satellites. They might even eliminate the power lines altogether—a furnace-size unit to supply your house may be on sale by 1965.

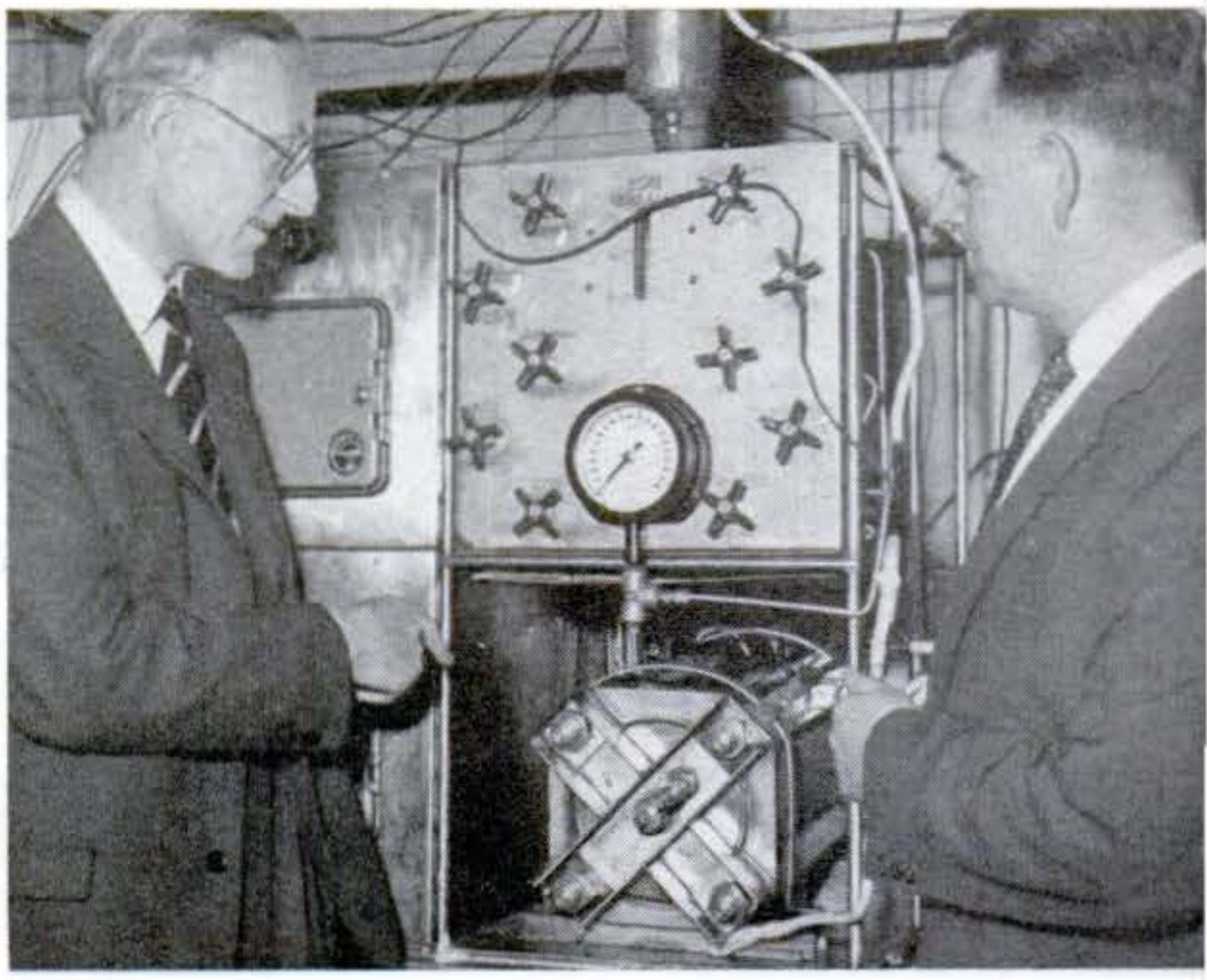
To trigger an upheaval like that, the new batteries have to be something special. They are. They're called fuel cells. They make electricity the same way flashlight cells and auto batteries do, from a reaction between chemicals. The difference is that the chemicals are not stored inside the cell, but are supplied through pipes from outside. Fuel cells keep on generating power as long as you keep feeding in the chemicals.

One chemical is oxygen (ordinary air is okay, but less efficient). The other is a fuel such as hydrogen (the best), propane cooking gas (used in the tractor), gasoline, or alcohol. A catalyst inside the cell makes the fuel combine with oxygen without actually burning. Energy is released, not in the form of heat, but as electrons that get pushed out the electrode and into the wires: an electric current.

What's so wonderful about this is that it ties into one package most advantages of gasoline power and electric power, and kicks out most of their disadvantages. Here's a quick rundown:

- Plenty of power is available. The tractor pulled 3,000 pounds at the drawbar, ample for a multiple-bottom plow. It carried a standard 20-horse DC motor, supplied by four banks of fuel-cell batteries that weighed about a ton and filled the normal engine space. Another type of fuel-cell battery generates 20,000 watts, yet is only as big as a tank-type vacuum cleaner.
- They're cheap to run. Unlike dry

British version of fuel-cell



INVENTOR BACON (left) shows his battery to Dr. H. H. Chambers, designer of another type that uses cheap fuel at high temperatures.

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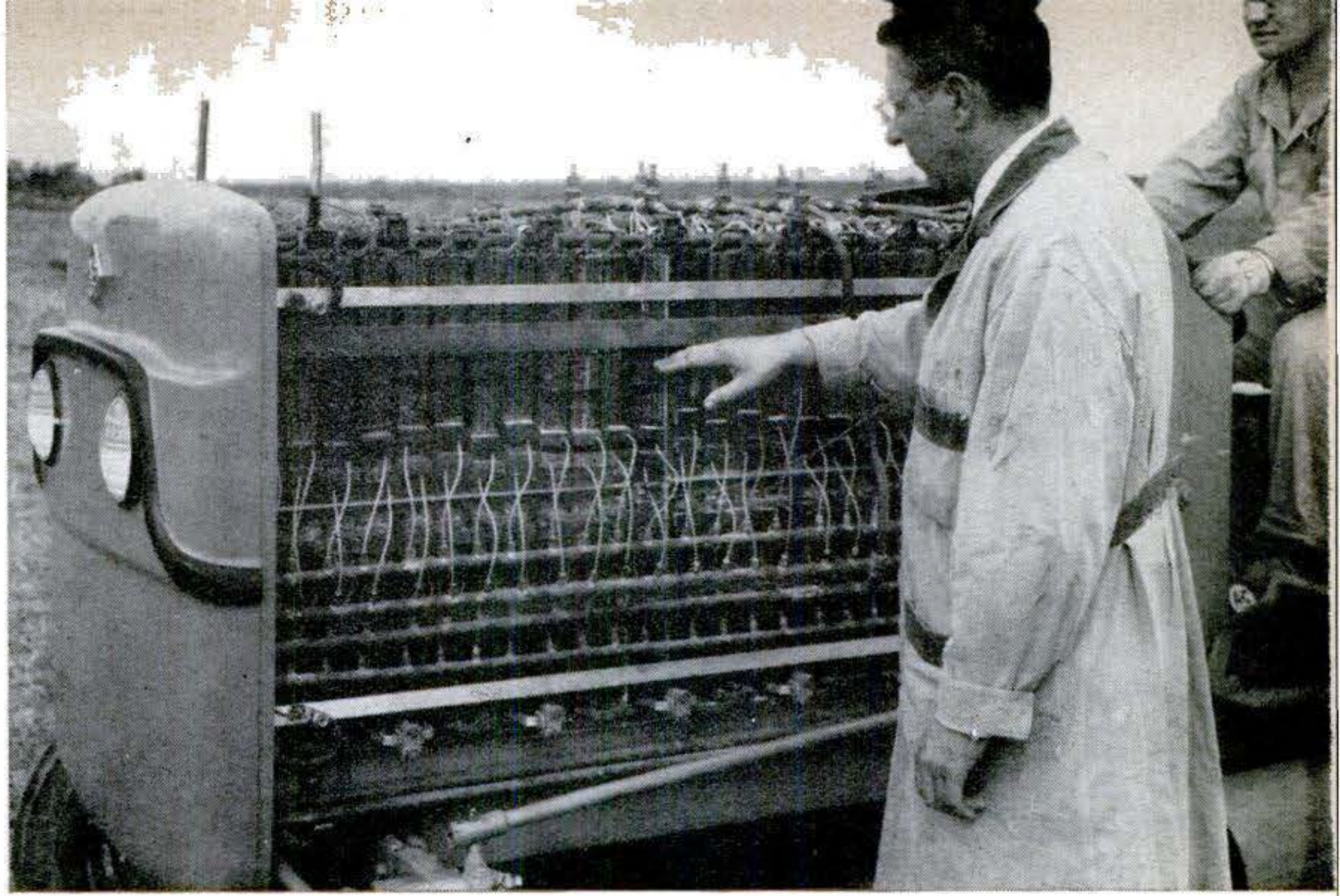


1,008 CELLS—assembled into 112 batteries, nine cells to a battery—are needed to generate 15 kilowatts DC for the tractor. Bus bars (bright metal strips) carry the juice to the controller and then to the motor—a standard 20-horse model. The tractor runs about three hours before the gas tanks empty and have to be replaced—a simple job.

cells, which consume expensive zinc, fuel cells use up common stuff—propane already powers many taxis, and hydrogen is now mass-produced. Unlike storage batteries, fuel cells need no recharging—you just hook on fresh tanks, with no more trouble than gassing up a car.

• They're efficient. Theoretically, fuel cells can convert every bit of the chemical reaction's energy into usable electric power: 100-percent efficiency. Actual cells already built run around 75 percent. Today's best engines (steam, gasoline, or diesel) never do better than about 40 percent. Engines are doomed to mediocre efficiency by the laws of thermodynamics, which don't apply to fuel cells.

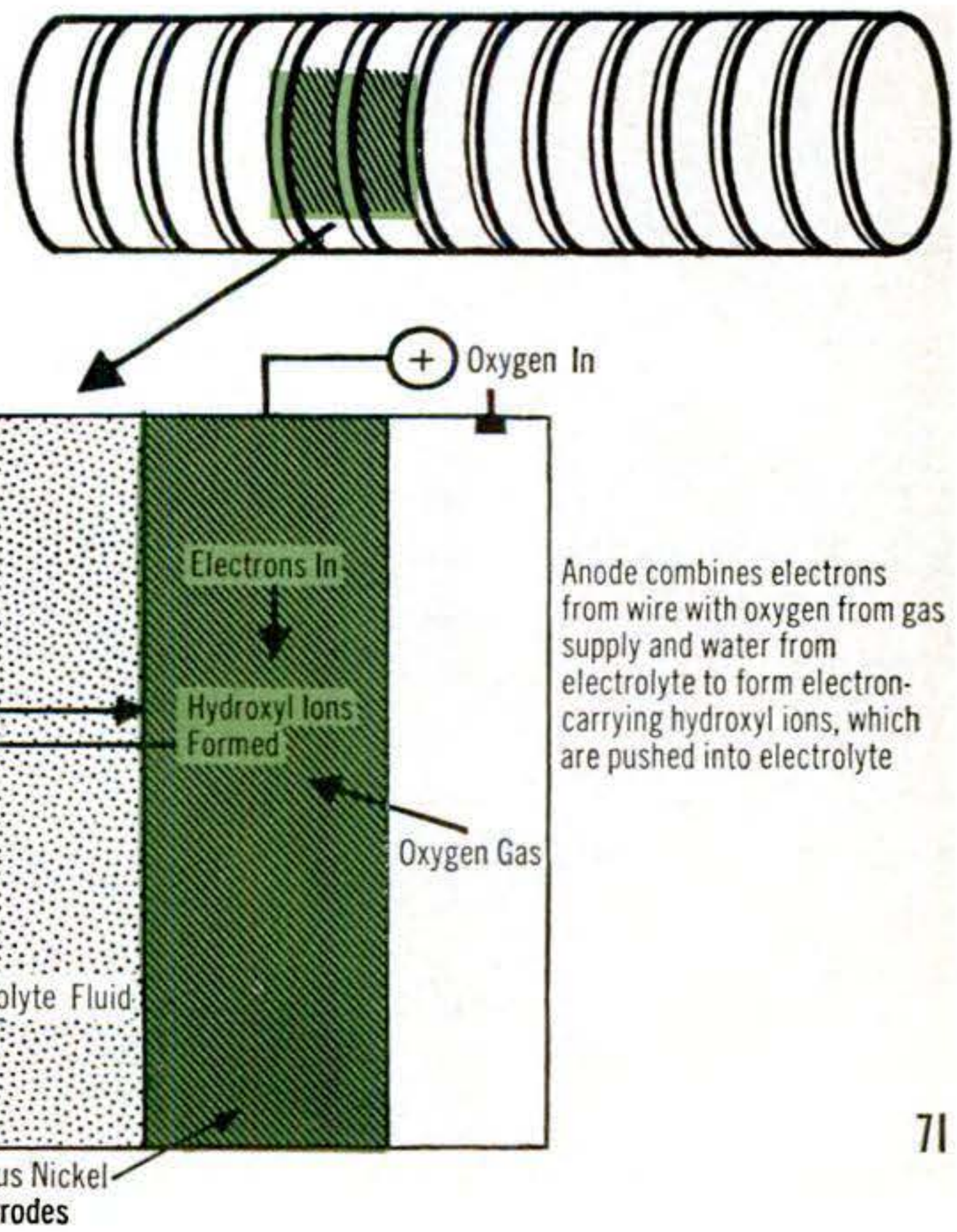
• They're civilized. Fuel cells are quiet (there's a gentle whoosh of gases, barely noticeable), they don't foul up the atmosphere (the exhaust is water plus; in the case of carbon-containing fuels, harmless carbon dioxide), and they can start pouring out juice the instant you open the valves.

Why didn't somebody think of this before? A lot of people did. Sir William

[Continued on page 250]

battery will furnish auxiliary power in U.S. Air Force planes

COMPACT, POWERFUL BACON UNIT demonstrates principle of all fuel cells. Fuel combines with oxygen in steps, so that little heat is generated, but electrons are released. Unlike the Allis-Chalmers device, the Bacon cell requires heat, pressure, and pure hydrogen fuel.



Cathode combines hydrogen from gas supply with electron-carrying hydroxyl ions from electrolyte. This forms water, and frees electrons, which are pushed into wire. Half the water is returned to the electrolyte, half pushed out as waste

Anode combines electrons from wire with oxygen from gas supply and water from electrolyte to form electron-carrying hydroxyl ions, which are pushed into electrolyte

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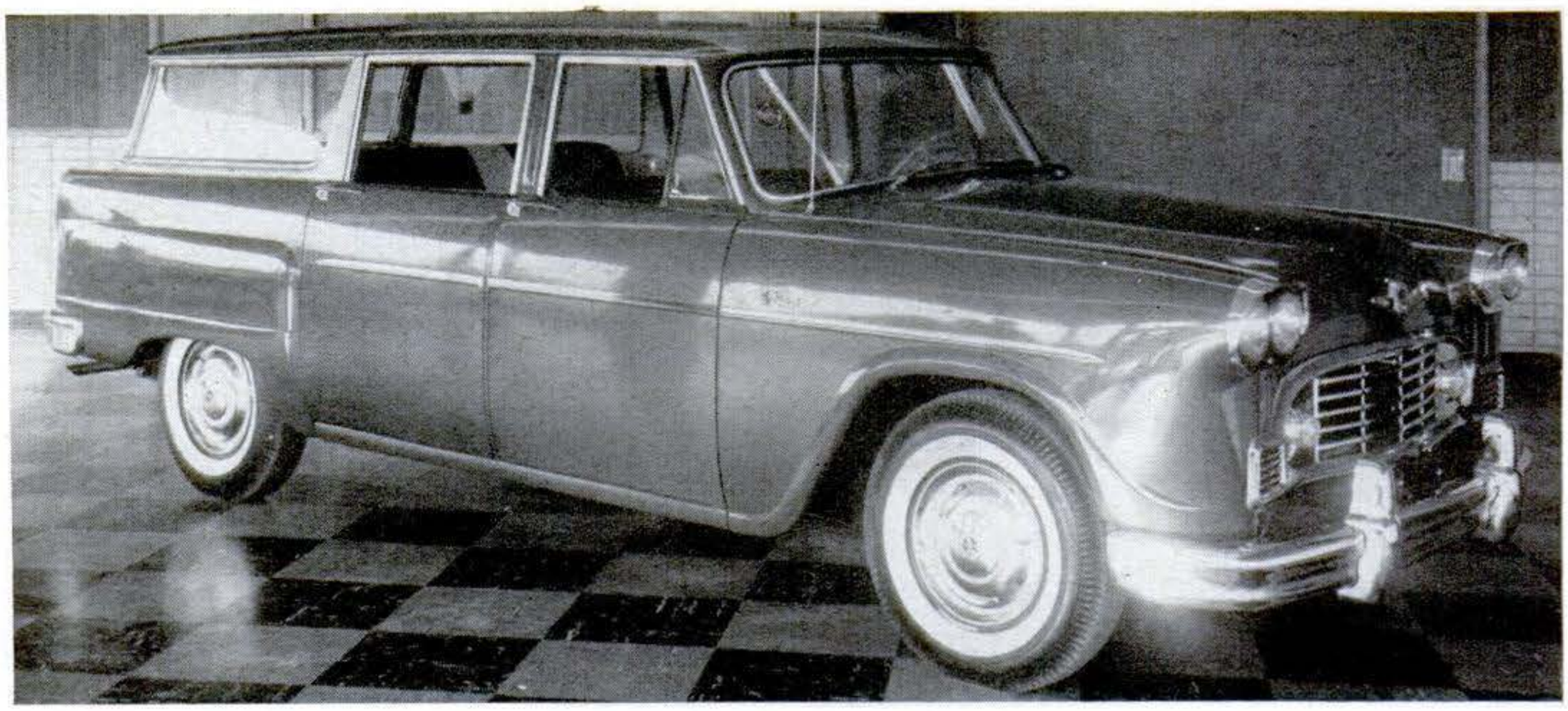
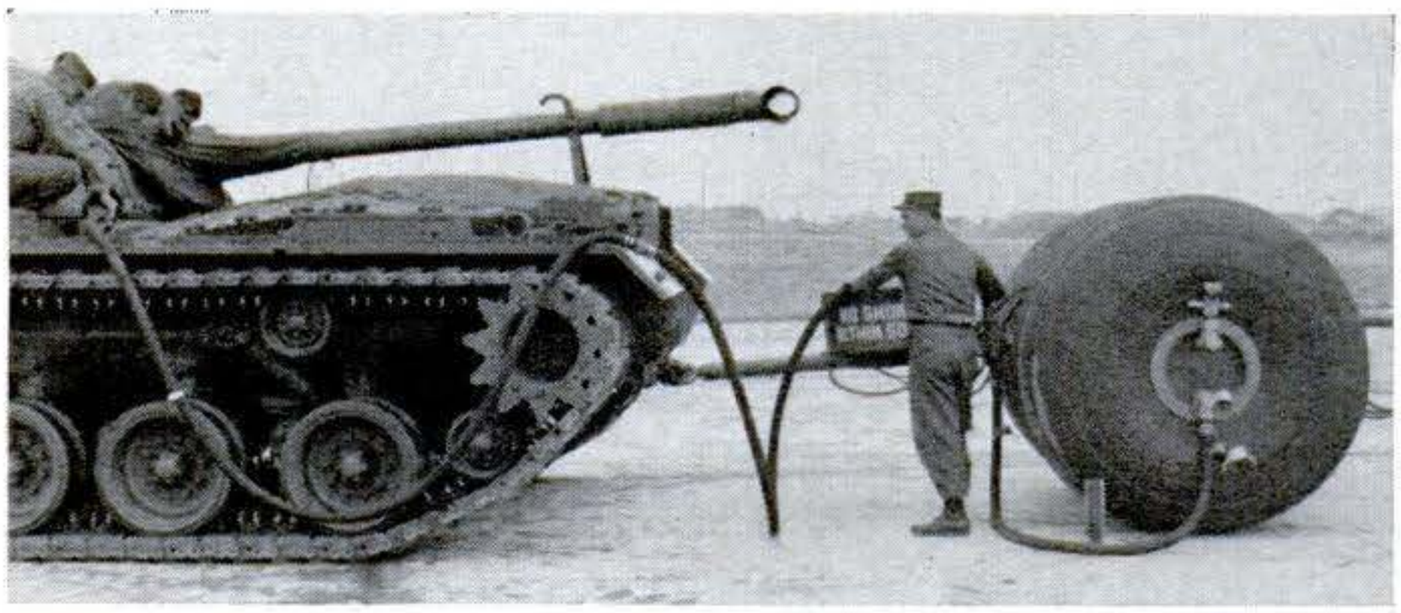


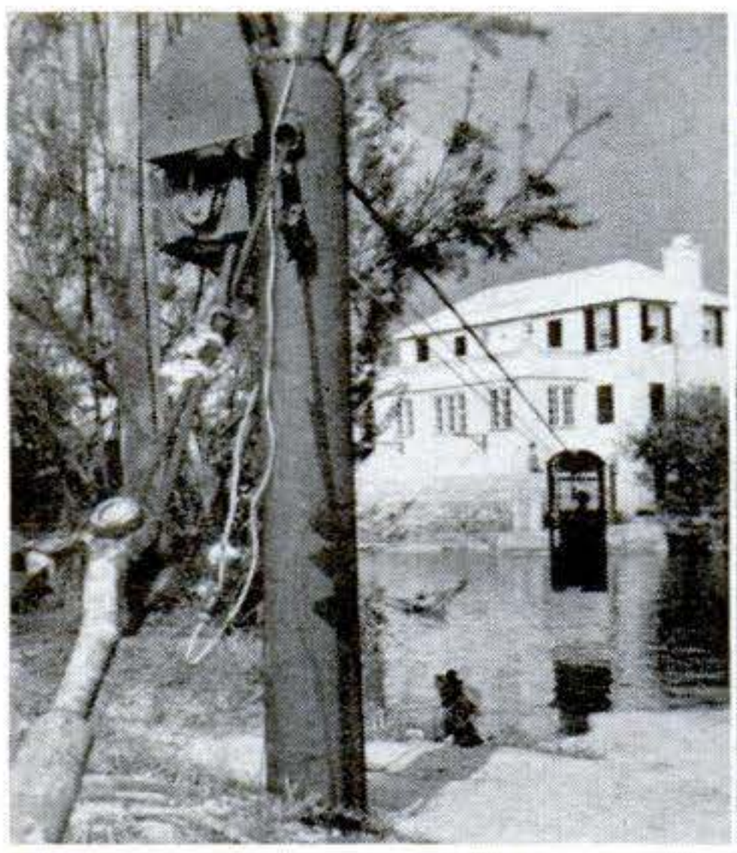
WAGON AND SEDAN ARE PRIVATE TAXIS

The company that makes the familiar Checker taxicab is now manufacturing sedans and station wagons for the general public. Two feet shorter and five inches narrower than current Chevrolets, Fords, and Plymouths, the Superba, as Checker calls it, comes powered with either an 80-hp. L-head or a 122-hp. overhead-valve engine.

The station wagon's roomy cargo compartment is 109 inches long, 58.7 wide, and has a maximum height of 33.6.



SELF-FUELER. Refueling from a supply inside four five-foot-diameter "tires" towed behind, the M48A2 tank at left multiplies its range by more than seven times. Each of the big rolling units on the transporter adds 500 gallons to the vehicle's tank.



Little car connects islands.

Pull chains on roof operate motor, change direction of travel.

ISLAND DWELLERS COMMUTE BY CABLE CAR

Living on a tiny islet in Hamilton Sound, Bermuda, can be fun. The Bronson Hartleys installed a cable car to the main island to transport people and groceries. The car rides on a 137½-foot cable. Controls inside operate an electric motor on the islet. A bell hung from the bottom tinkles on landing.

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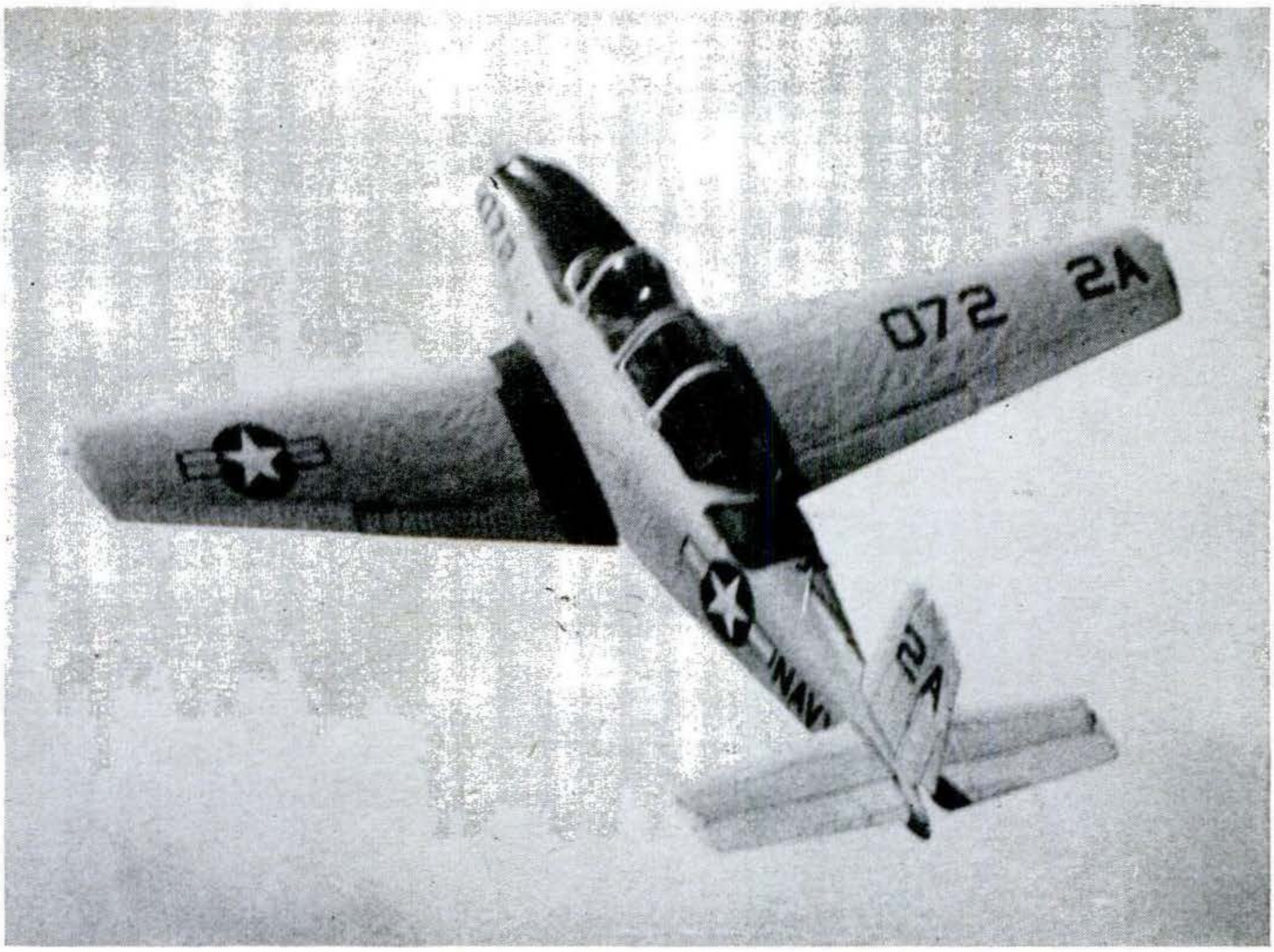
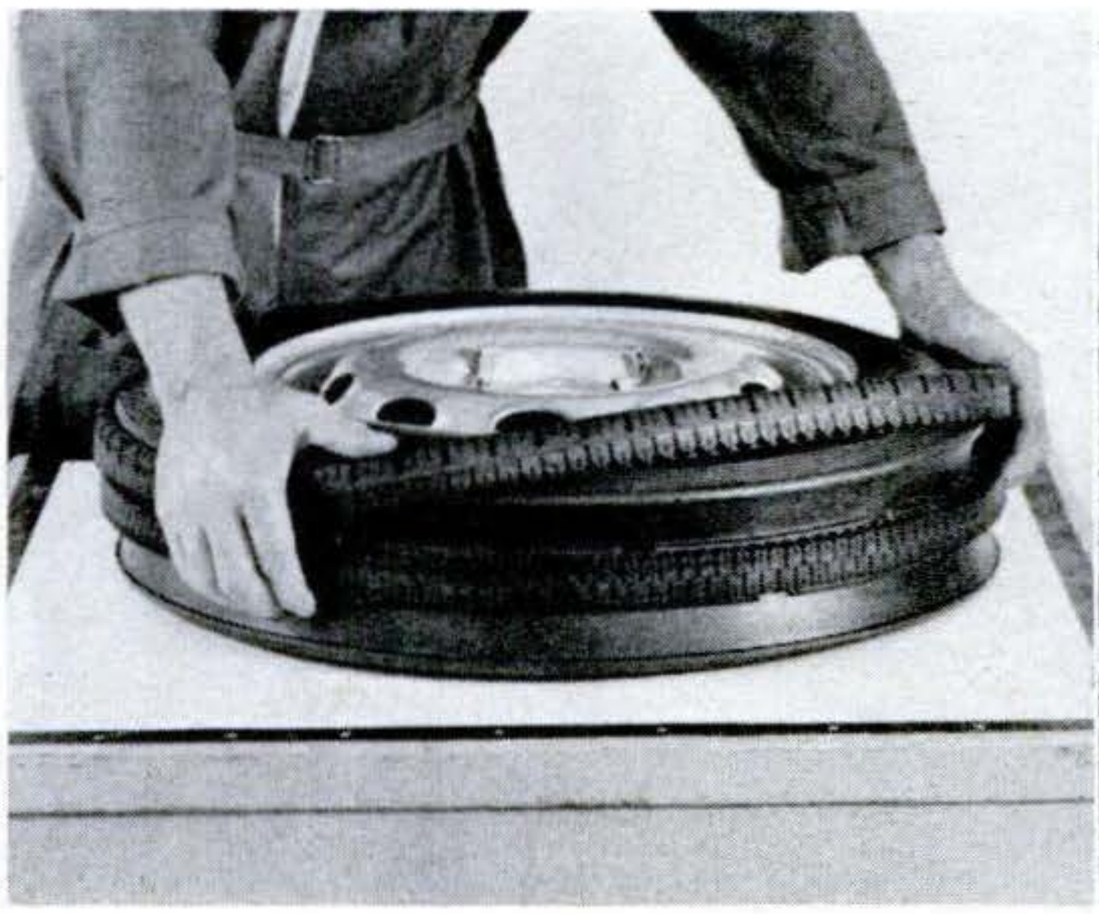
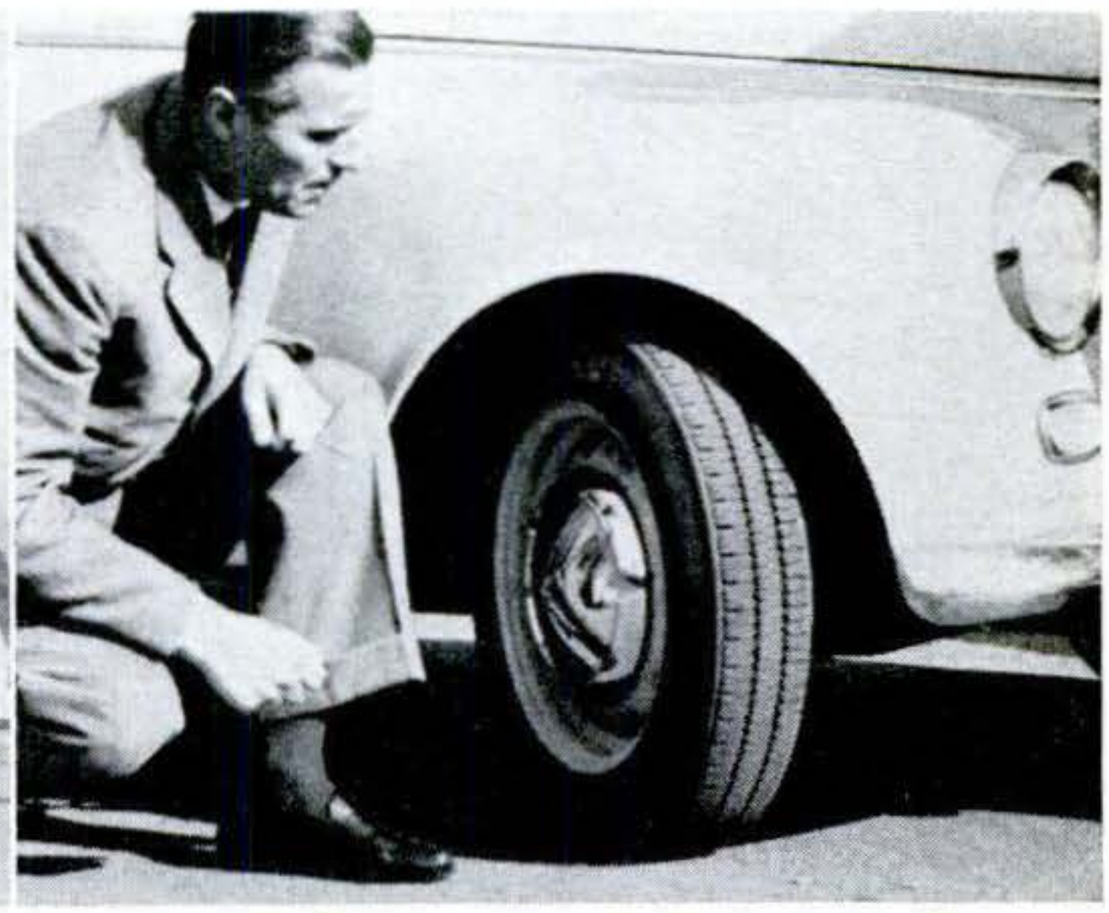


STRESSES PUT CRINKLE IN PLANE WINGS

This unusual photo shows the wrinkled skin on airfoils of a Navy Beech T34B trainer during a hard pull-up. Catching the action of stresses on film called for a triple play: a high-gravity pull-up, sun rays falling at a low angle on the wings, and the snap of the camera shutter at precisely the right instant.



Treads ease on deflated casing without tools . . .



. . . fit snugly into grooves and won't slip.

REPLACEABLE TREADS INCREASE TIRE LIFE

Here's a new tire that has treads you can replace when worn, shift for rotation, or change to fit the season. The separate treads—three rubber bands—stretch over the casing and lock into place. Pirelli of Milan, Italy, makes the tire. Interchangeable winter treads can be fitted with spikes for use on ice.

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POPULAR SCIENCE here presents the second of three articles on Detroit's new compact cars.

Last month we told you what we had found out about the Chevrolet Corvair in 10,000 miles of driving. This month we give you the results of our 10,000 miles in a Ford Falcon. We drove through 21 states and into northern Mexico, in fair weather and foul, over good roads and bad. Next month: 10,000 miles in a Chrysler Valiant.

No other magazine has ever attempted 30,000 miles of driving in a period of three months to collect detailed information on how new cars behave in everyday service.

Like the Corvair, the POPULAR SCIENCE Falcon was purchased at its full retail price from a regular dealer. It was a manual-shift, two-door sedan, with only a heater and radio as accessories.

HOW THE FALCON DID

THE PERFORMANCE

Total distance covered	10,780.7 miles
Gasoline used (non-premium)	405.9 gal.
Average miles per gallon	26.56
Oil burned	1 qt.
Gas mileage at constant speeds	
30 m.p.h.	30.2 m.p.g.
40 m.p.h.	29 m.p.g.
50 m.p.h.	28.1 m.p.g.
60 m.p.h.	27.1 m.p.g.
Gas mileage in stop-and-go driving	22.4 m.p.g.
Acceleration	
0-60 m.p.h.	22.9 seconds
40-60 m.p.h.	13 seconds
50-70 m.p.h.	16.5 seconds
Top speed	78 m.p.h.

Speedometer error

Indicated Speed	Actual Speed
40 m.p.h.	38 m.p.h.
50 m.p.h.	48.5 m.p.h.
60 m.p.h.	57.6 m.p.h.
70 m.p.h.	68 m.p.h.

THE COSTS

Gasoline		$131.12
Oil burned		.50
Gas-oil cost per mile		.0122
Repair and maintenance, including adjustments at 500, 1,000, 5,000, and 10,000 miles		
Oil and filter changes	$9.83	
Lubrication	3.00	
New points	1.95	
Total labor	12.75	
Total		27.53
Overall direct operating cost per mile		.0147

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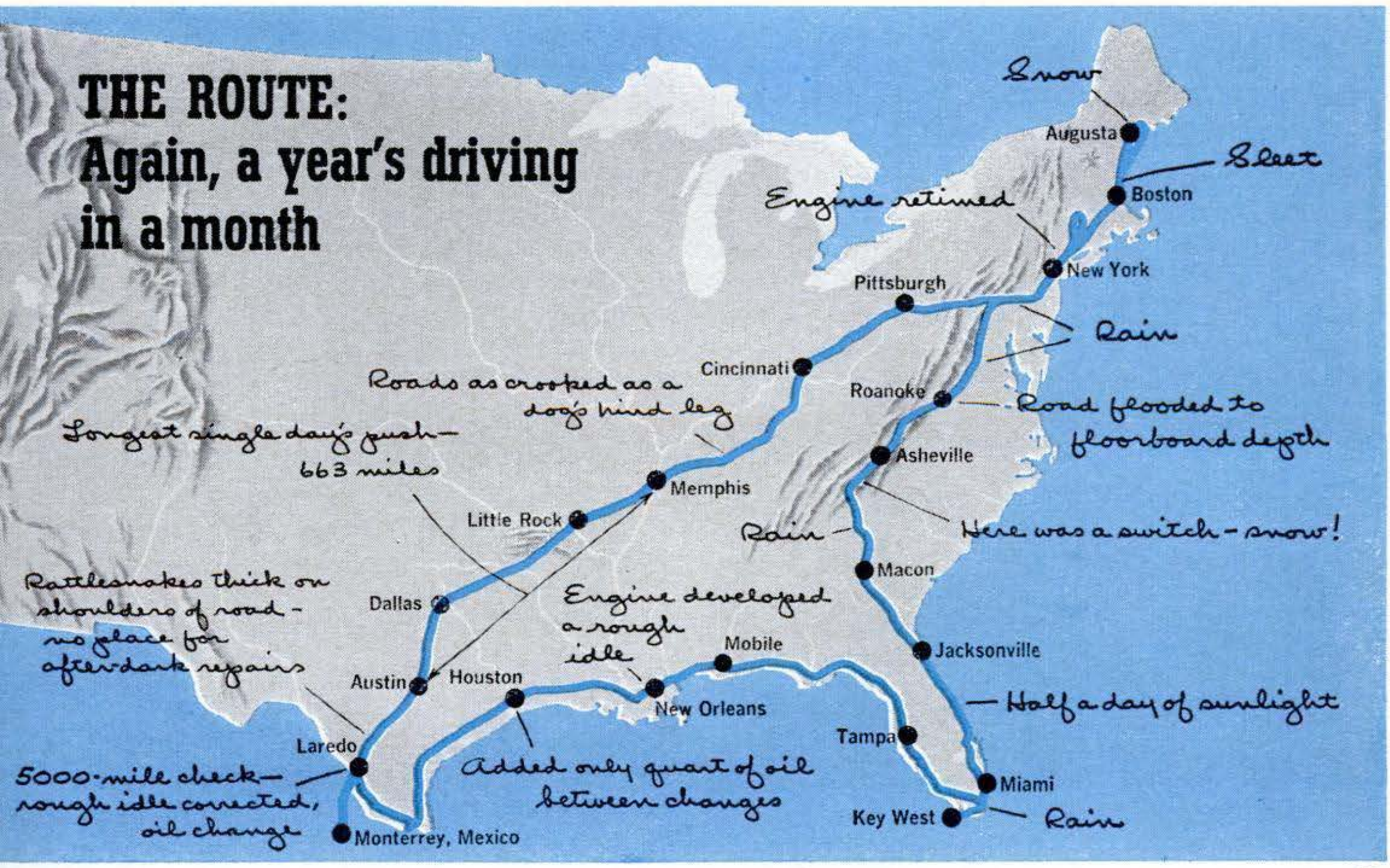
Testing the Ford's compact little brother:

10,000 MILES IN A FALCON

FOR more than a quarter of a century, U. S. motorists—including you, maybe—have badgered the Ford Motor Co. with the question: "Why don't you bring back the old Model A?" Well, it has. Only now, the car has another name. Ford calls it the Falcon.

Its ride is not so very different from the old Model A's. It drives pretty much like the old Model A. It weighs just about what the old Model A did, and accelerates much like it.

But there the comparison ends. The Falcon is a couple of feet longer, five inches wider, and almost five inches lower. It has six cylinders instead of four, and more than twice the horsepower. It goes considerably farther on a gallon



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How the Falcon Compared with the Corvair

	FALCON	CORVAIR
Overall average miles per gallon	26.56	23.43
Gas mileage at constant speeds		
30 m.p.h.	30.2 m.p.g.	26.6 m.p.g.
40 m.p.h.	29 m.p.g.	24.2 m.p.g.
50 m.p.h.	28.1 m.p.g.	23.6 m.p.g.
60 m.p.h.	27.1 m.p.g.	22.6 m.p.g.
Miles per gallon in stop-and-go driving	22.4 m.p.g.	21 m.p.g.
0-60 acceleration	22.9 sec.	17 sec.
Top speed	78 m.p.h.	88 m.p.h.
Total oil consumption	1 qt.	4 qt.
Gas-oil cost per mile	$.0122	$.0145
Overall direct operating cost per mile	$.0147	$.0184

of gas. And it costs four times as much.

Members of the POPULAR SCIENCE staff turned up a bookful of facts and opinions on the Falcon. They put calipers on each facet of its operation. The ground they cover below includes gas mileage, handling, ride, performance, design, comfort, styling, and conclusions.

On two virtues of the Falcon there was no arguing with the facts: It was economical on gas and oil, and it ran those 10,000 miles without a mechanical breakdown. On other points—as you'll soon see—the reactions varied widely.

The Gas Economy

Henry Comstock: I made up to 663 miles a day. My average was 556. Yet on only three days out of 14 did I have to stop for gas more than twice—on an 11-gallon tank!

Falcon sped along at top speed limit on superhighways like this. Delaware Memorial Bridge is in background.

Hubert Luckett: For 300 miles of commuter-type driving, I got 28.2 miles per gallon. For 152 miles of highway driving, including numerous hard acceleration trials, the Falcon registered 26.3.

Howard Allaway: I can beat that. My average on the parkways, where the speed limit is 40 to 50, was 28.3.

Frank Rowsome: The gas mileage varies a lot, of course, with the type of driving. On one 760-mile day, driving so hard that I averaged 50.7 miles an hour —including time out for gas—I got 21.6. When I took it easier, it jumped to 25.6.

Allaway: That's exactly what I got on a long weekend of fairly hard driving.

Comstock: Maybe my overall average will be a better clue. I covered almost 6,500 miles going to Mexico and back. That included a lot of city driving at peak traffic hours in New Orleans, Jacksonville, Miami, Tampa, Mobile, Houston, San Antonio, Dallas, Little Rock, Memphis, Cincinnati, and Pittsburgh. I averaged 26.5 miles to the gallon. I got 29 to 30 at road speeds of 50-55, with frequent drops to 25 m.p.h. through towns.

Devon Francis: It wouldn't surprise me if gas station owners declared the Falcon illegal. The Chevy Corvair can't match it for economy.

The Handling

Rowsome: The handling is fair. The car heels and jitters on hard corners.

Luckett: Not in my book. The handling on twisting, curving mountain roads was exceptionally good. Heeling on turns is slight, and the road-holding ability ex-

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Gassed up, the Falcon first crossed Mexican border at Reynosa.

Mountain switchbacks north of Monterrey proved a rugged test.

It had to share bumpy roads with burro-drawn wagons on round trip into Mexico.

cellent. The car has a good sense of direction.

Martin Mann: I found that the Falcon takes sharp curves flat at high speed. It makes time beautifully on twisting, crowned mountain roads.

Allaway: I felt more at ease in hard-driving traffic than in the standard-size car that I drive every day. The car stays flat on turns.

Luckett: It's decidedly wind-sensitive at high speeds.

Rowsome: Yes, I was about to say that. Moreover, the steering is slow and a little numb. But there's little road shock, and the wheel unwinds on release. Parking takes a lot of wheel spin.

Francis: You mean, wheel tug. My wife complained about that. The car isn't up to the Corvair in handling. Mark me down for excessive wheel road-shock.

Comstock: Mark me down for liking the roadability. The car stayed glued to the pavement.

The Ride

Mann: The ride is gentle.

Francis: Not compared with the Corvair's, by any means. I found it as stiff as a shirt on a clothesline at Christmas.

Rowsome: That's an exaggeration. The ride's a bit harsh, with some pounding and thudding. I got noise and shock on some concrete expansion strips. Oddly

How the Falcon's Tires Stood Up

A tire expert measured tread depth at 10,780.7 miles. Since the 6.00 x 13 Goodyears had not been switched at 5,000 miles, four instead of five tires shared all the wear. Each left-side tire had lost 30 percent of its tread, right-side tire 35 percent. High-crowned roads, the expert said, accounted for the difference. His estimate of projected tire life: 33,000 miles on four tires, or 41,000 on five switched.

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New M-60 tank provided contrast in size at Army's Aberdeen Proving Ground.

enough, the ride isn't bad on rough roads if they're taken fast.

Allaway: I'd say the ride is fair-to-good. I did find some pounding and instrument-panel chatter and buzz on bricks and washboard.

The Performance

Rowsome: This car's big drawback is its 3.1:1 rear-axle ratio.

Comstock: With the Falcon, you have to go back to your driving habits of 20 years ago. At first, it's a chore to downshift in traffic—high is not a traffic gear.

Rowsome: Neither is high in the Corvair.

Francis: Yes, but the Corvair accelerates better.

Mann: The lack of torque is annoying in traffic and in starting up a hill. But I got used to the frequent shifting.

Allaway: That was my main complaint. The Falcon ran out of steam on long hills, especially in 35-40-m.p.h. zones.

Rowsome: It doesn't pass well up to 45 or 50 m.p.h., and it's almost a public nuisance on long, steep highway climbs.

Comstock: That's funny. I found the acceleration lively up to 55 or 60, once I got rolling. Low gear did annoy me. It isn't synchronized. You have to be good at double-clutching to shift to low while you're under way—or take back-talk from your dentures.

Rowsome: When I drove the Falcon, it didn't seem right. It had gone some 8,000 miles and needed tuning.

Luckett: The engine obviously needed sharpening up when I took over right afterward. It was blubbery in second gear, and in high the engine was rough when I accelerated in the 40-60 range. I got the plugs cleaned, and nudged the timing from two to six degrees before top dead center. Doing this shaved three seconds off the 0-60 time.

Francis: On performance, just let me say that the Falcon has no really bad habits, and that the axle ratio degrades its good ones.

The Design and Controls

Allaway: The Falcon has a familiar feel and sound. The engine is up front. The shift is on the steering column.

Comstock: I suppose we could quibble indefinitely about the Falcon's shortcomings. The vacuum-powered wiper blades do a minimum job when the throttle's open. But I found that mechanics and amateur car buffs liked the Falcon's uncluttered engine compartment.

How Well Was It Designed and Built?

The Falcon is, in general, a well-designed and well-assembled automobile. But all cars have their faults, and the Falcon is no exception.

The springing is somewhat harsh.

The wind-wander is excessive in strong cross-gusts.

The driver's seat has insufficient travel for short legs, and the steering-wheel spokes fret long legs.

Control knobs on the panel could be dangerous in a collision.

When down, the left sun shade interferes with sight in the rear-vision mirror.

The standard rear-axle ratio is heavily biased in favor of fuel economy, at the cost of performance.

A number of under-dash rattles, and noise in the speedometer, developed.

Assembly quality was fair to good. But a need for excessive accelerator pressure in the upper speed ranges turned out to be interference with the linkage by a badly positioned heater hose.

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Francis: The panel design, with its projections, is a potential danger in a crash or even a panic stop.

Luckett: You're not giving the Falcon its just due. For instance, the engine starts quickly after a cold, wet night at the curb—provided the manual choke is used intelligently. (Why is it that women can't learn that?) The clutch action is smooth and easy.

Mann: But the clutch and brake pedals are too small and too close together—almost as bad as the Volkswagen. Every time I hit the clutch, my foot got tangled up with the left fresh air vent.

Rowsome: I'd say the brakes and transmission are fine.

Allaway: The push-pull controls are pleasantly simple except for the wiper knob, which twists. Why couldn't that be push-pull, too?

Luckett: That *is* quibbling. The transmission and engine are quiet. That's quite a plus. The shift is crisp and of reasonably short travel. As for the wipers, they're noisy but effective. They wipe parallel, and they clean that dead spot in the center of the windshield.

Comstock: At night I got a windshield reflection of the panel. The instrument panel, especially the gas gauge, is overstyled, by the way.

Mann: I liked it. And the visibility all around is superb.

Rowsome: I was agreeably surprised at the light the two headlamps could throw.

Francis: Not as much as the Corvair's four.

Comstock: Nobody has mentioned the hood. It's not counterbalanced, and you have to prop it up for servicing.

Francis: Nobody has mentioned the fuel filler pipe, either. It has a flat entry. I never once got gas without its gushing out when the tank got full.

Comstock: Yes, more than one pump jockey remarked that he'd hate to see the paint below the filler tube six months from now.

The Comfort Factors

Mann: The car is exceptionally roomy.

Comstock: Except for the transmission hump in front.

Allaway: I liked the leg room and the seat widths.

Luckett: The car is exceptionally easy

[Continued on page 232]

Slithering up a frozen logging road in Maine, lightly loaded Falcon lacked solid traction. But it got through.

Falcon parked cozily in space at curb that was too small for standard car.

NEXT MONTH: ***Don't miss Popular Science's report on—***

10,000 Miles in a Chrysler Valiant

—plus a comparison with Chevy's Corvair and Ford's Falcon.

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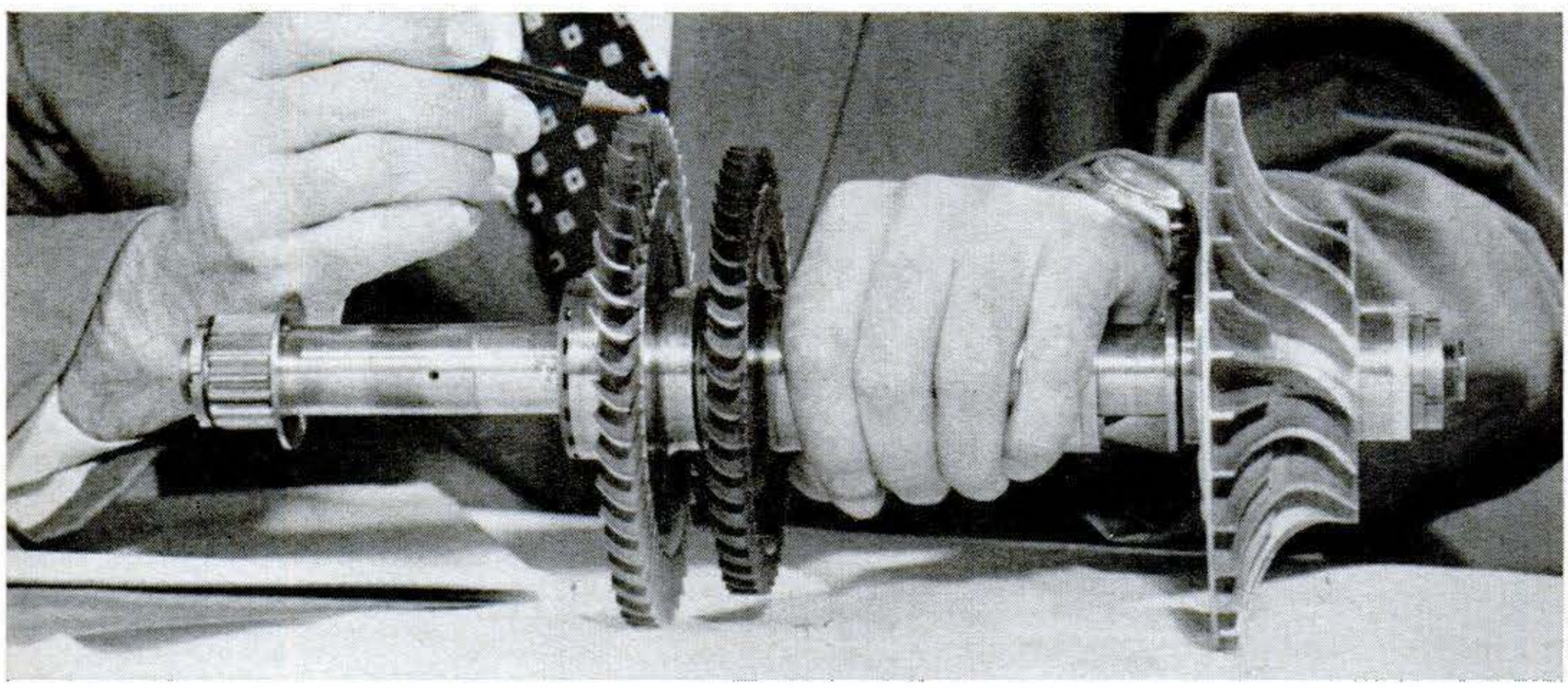
Two-door Corvair is almost identical with the four-door model, but will sell for slightly less.

COMPACTS BRING OUT SPORTY NEW MODELS

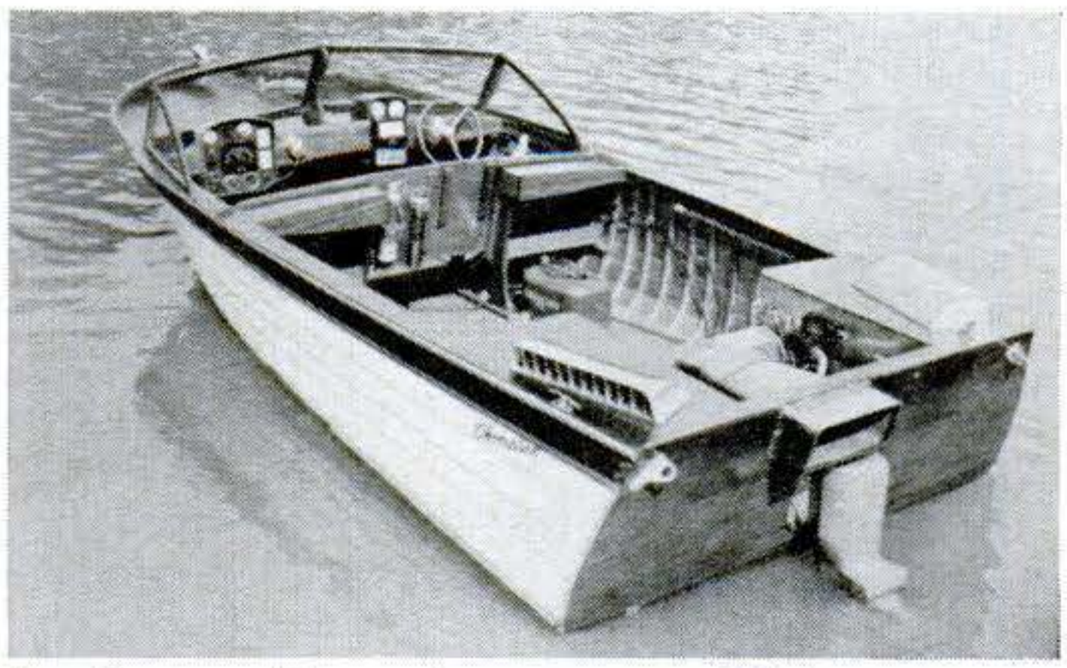
Detroit's newest compact cars are now appearing—or soon will—with variations in design. Chevrolet's rear-engine Corvair will have a two-door version this spring. Only four-door models are being made at present.



Chief components of Williams engine are two turbine wheels (left) and radial-type compressor.

NEW TURBINE DESIGN FOR BOATS OR CARS

A new lightweight gas turbine, producing a horsepower for each pound of weight, is designed for boats, small planes, or even cars. Not much bigger than a bread box, it runs at 58,500 r.p.m. The geared-down output shaft turns at 5,000. By routing exhaust gases through a heat exchanger, the turbine recaptures energy normally lost. It is made by Williams Research Corp., Walled Lake, Mich.



Engine on this cruiser puts out 75 horsepower.

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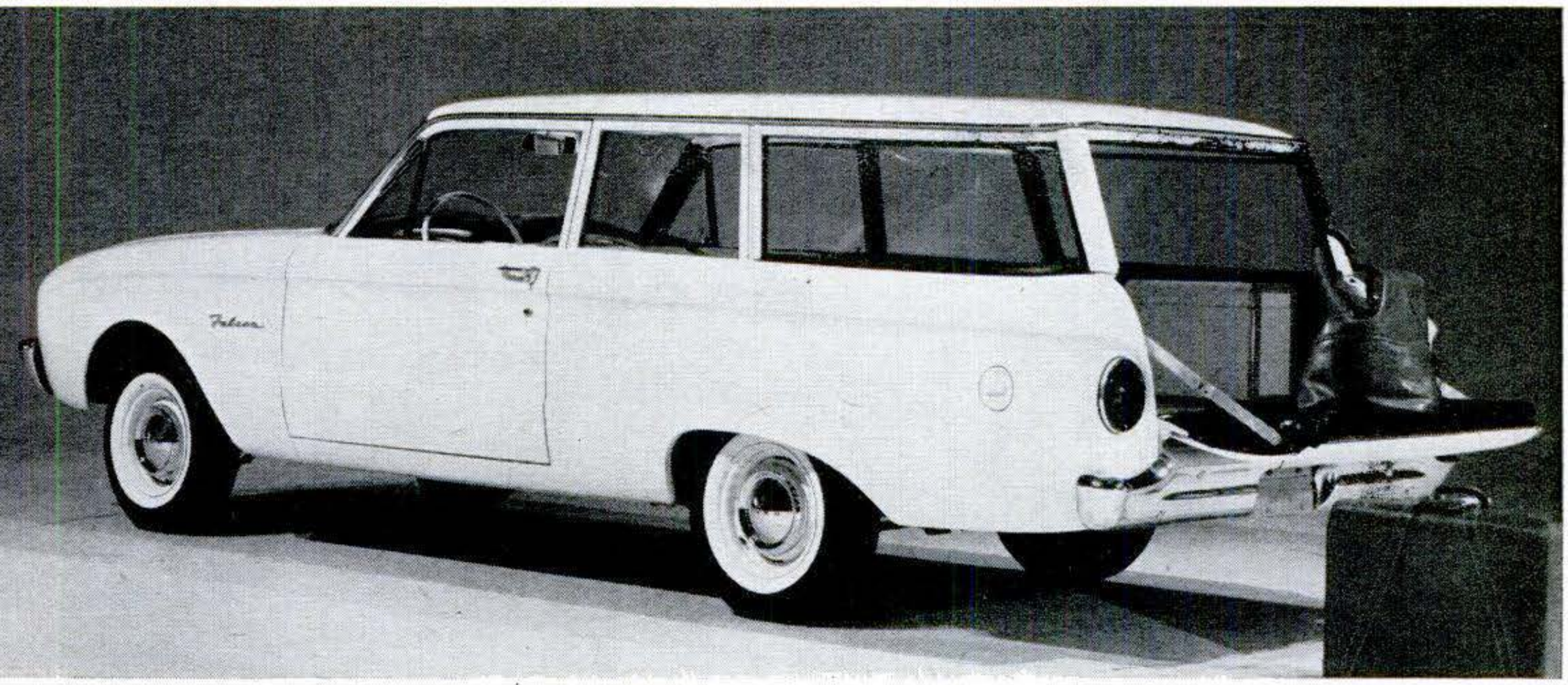
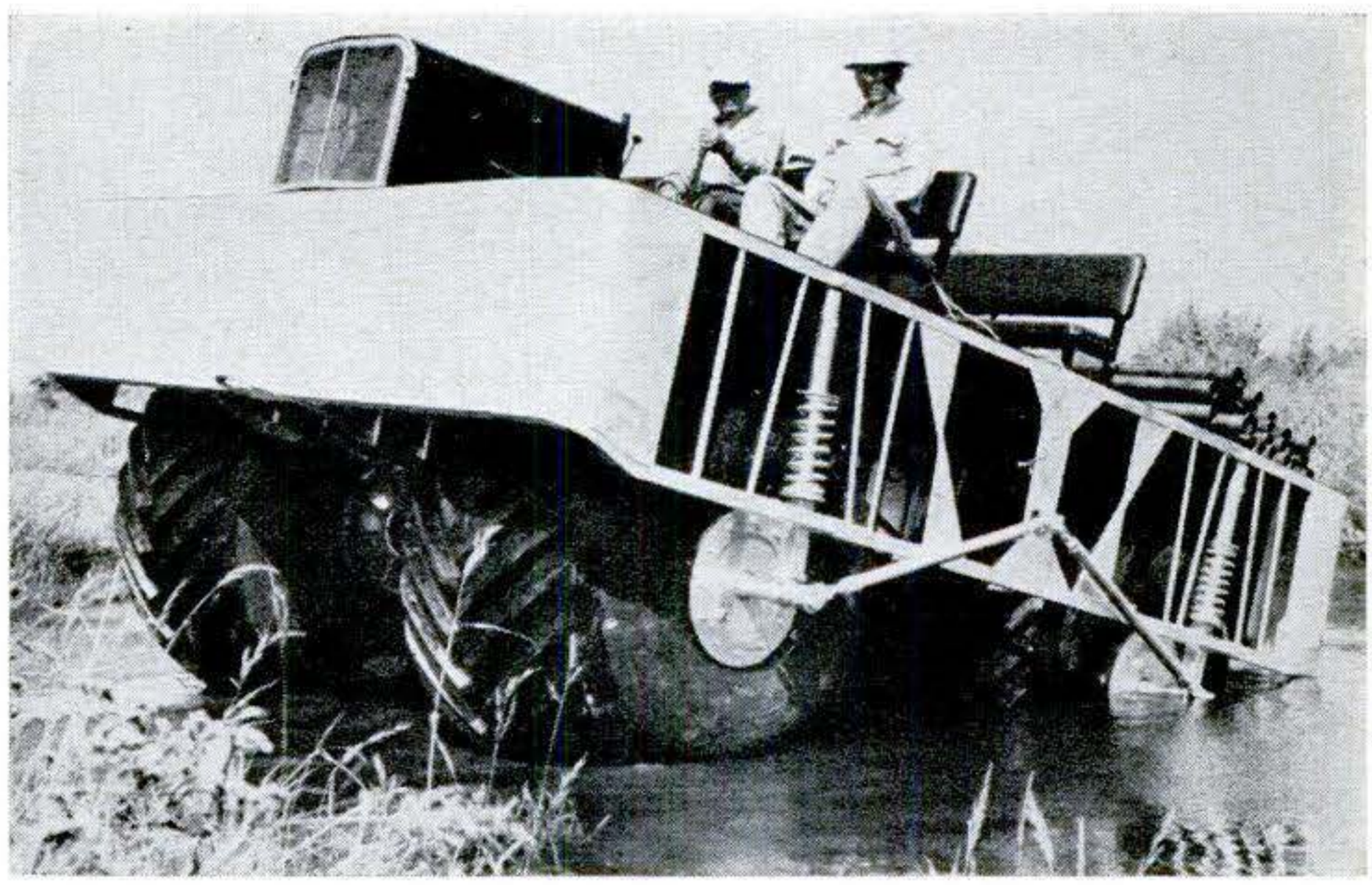


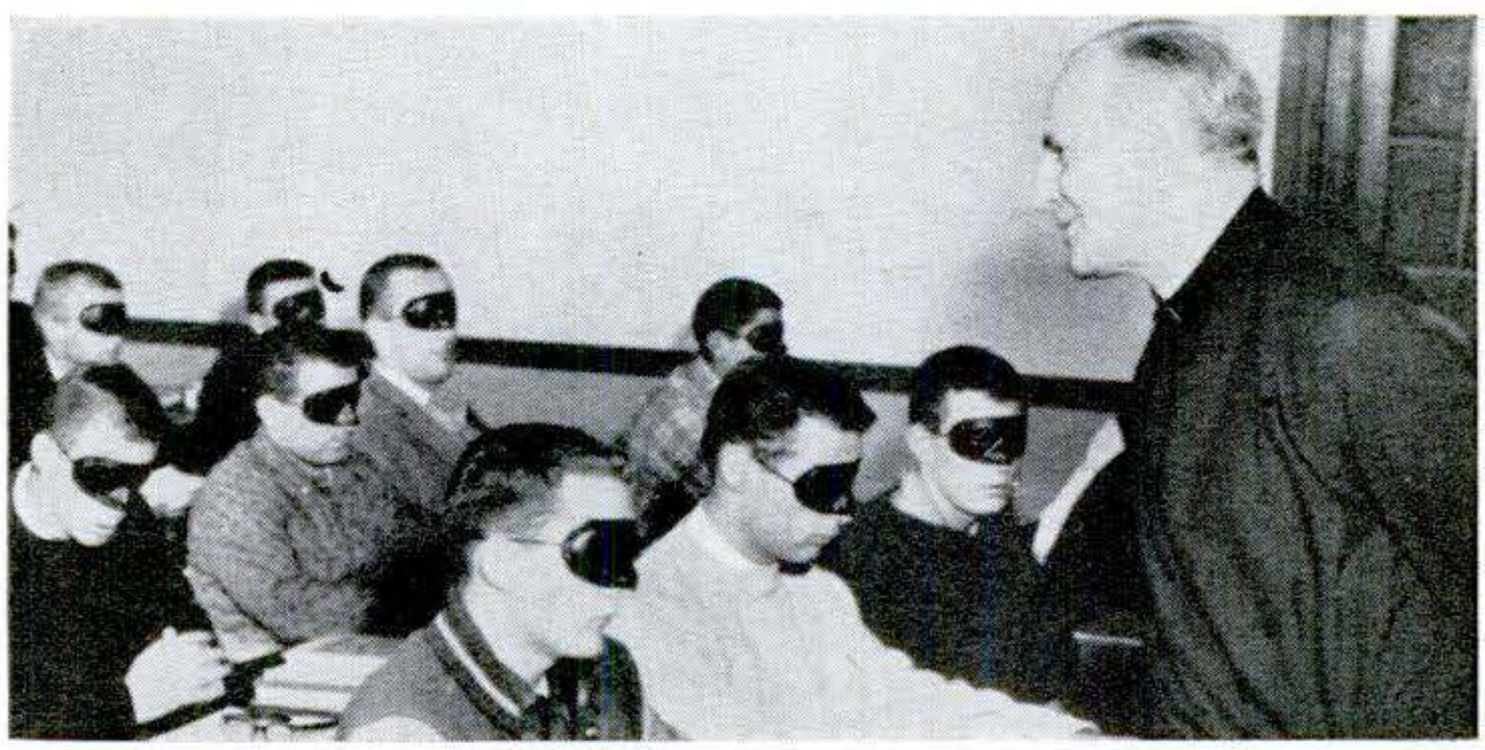
Falcon wagon has a curb weight of 2,631 pounds. It carries spare under cargo-compartment floor.

Ford Falcon six-passenger station wagons are being readied for the showrooms, with either two or four doors. Eight inches longer than the sedan—for a total of 189 inches—the wagons have a cargo area 106.6 inches long from the back of the front seat to the tip of the open tailgate. They have a maximum volume of 76.2 cubic feet. Loading aperture is 45.5 inches wide, 27 inches high.

HUGE WHEELS that are practically all tires enable this marsh buggy to tote as much as 4,000 pounds over soggy terrain without sinking in. Made by Crain Brothers of Grand Chenier, La., buggy is fitted with low-pressure Terra-Tires. They are five feet high and 42 inches wide. Vehicle is designed primarily for oil exploration and for carrying personnel into swampy areas. With a full load, gross weight is 8,000 pounds.



BLINDFOLDED students in a language class at the University of San Francisco are able to concentrate on what the teacher is saying without visual distractions. Father P. Carlo Rossi, the instructor, got the idea on an airliner where passengers were given masks to allow them to sleep despite bright sunlight outside.



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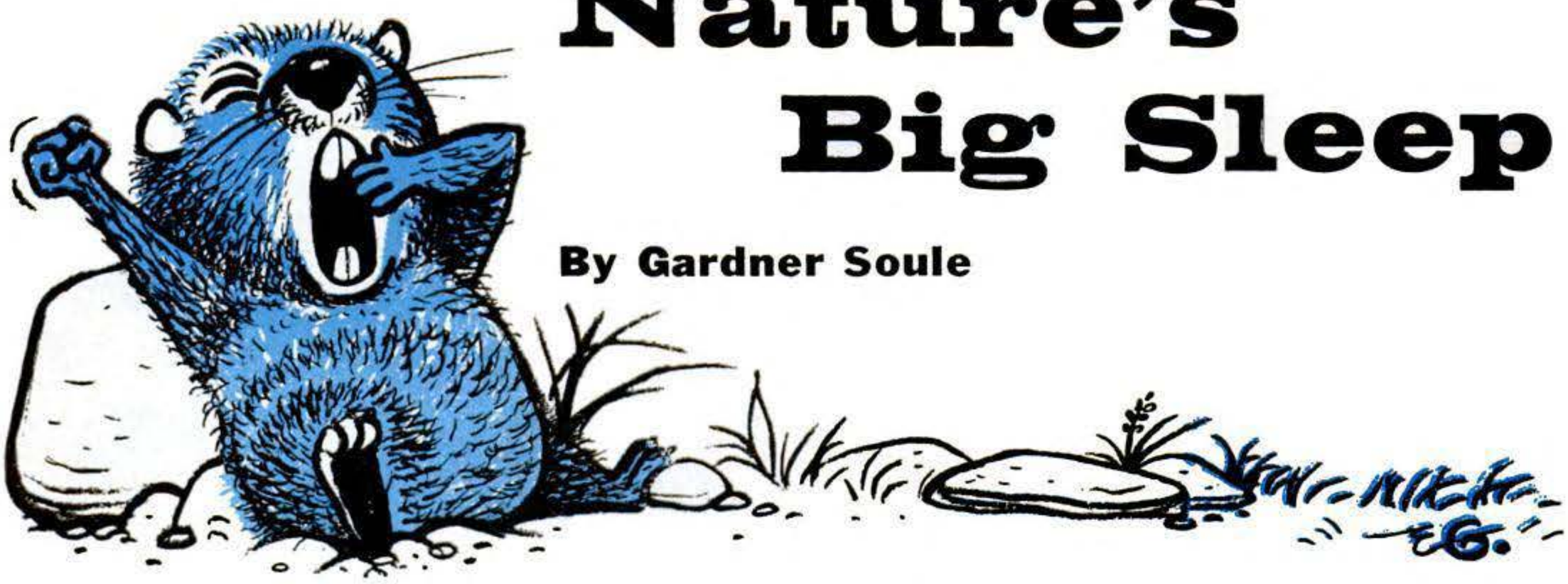
Science probes into the strange phenomenon of hibernation. Here's what we are learning about—

Nature's Big Sleep

By Gardner Soule



IF A groundhog sees his shadow on Feb. 2, does it mean we're going to have six more weeks of winter weather?

Few people, probably, believe so nowadays.

Nevertheless, scientists at no-nonsense research centers such as Harvard Medical School have lately been taking a closer look at the central character in the Groundhog Day legend.

Their studies are probing into one of nature's strangest mysteries: hibernation —that deep, deep sleep from which the woodchuck, or groundhog as he's also known, supposedly wakes on Candlemas Day each February.

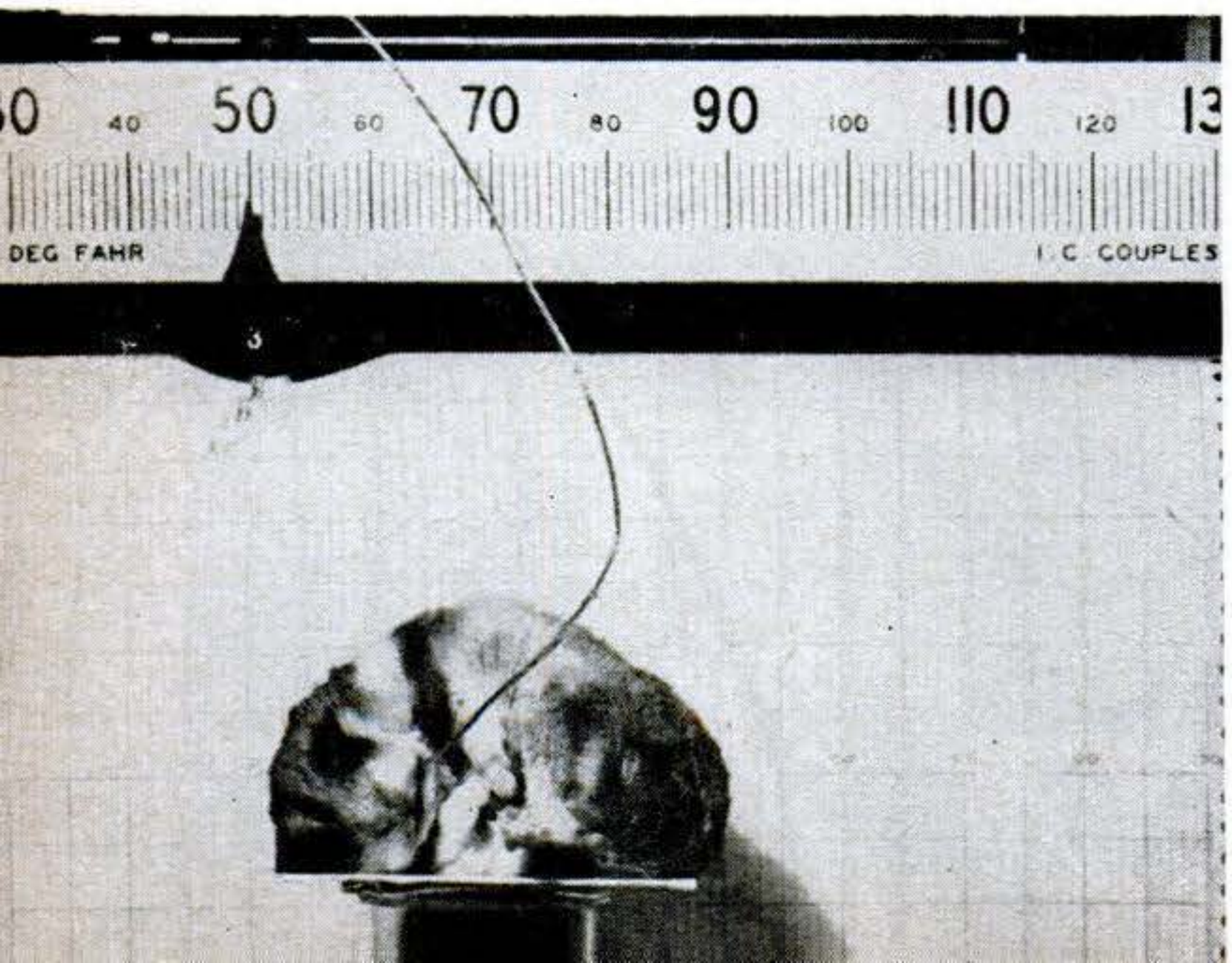
Their findings shoot some new holes in the legend. Says Dr. Charles P. Lyman, a Harvard biologist who has been studying woodchucks, hamsters, and other hibernating animals for the last 10 years:

The woodchuck is an even better hibernator than folklore gives him credit for being. He sleeps in a burrow, below the frost line, for six or seven months. And he is not likely to prowl around on Feb. 2, which to him is still midwinter.

But his hibernation is not, as often supposed, an unbroken sleep. The animal is very much alive, although the processes of life go on very slowly. The chuck, for example, wakes every three weeks or so to relieve himself. This may be the purpose of any trip he makes out of his burrow in February.

A strict vegetarian—as gardeners in the northern two-thirds of the U. S. can irately testify—the woodchuck would find little food around in February. In the Northeast, he is most often reported up and around in March; in Colorado, a

THE DEEP SLEEP: At 50 degrees F. in the Harvard Medical School cold room, a hamster curls up into a hibernating sleep that could last months. When the temperature in the room goes up to simulate the arrival of summer, the little animal rouses itself (below) and opens its eyes.



FAT AND SASSY: As winter approaches, the groundhog eats like a pig (though he's really a rodent), ballooning to as much as four times normal size. Will he be out forecasting the weather on Groundhog Day? Don't bet on it, say scientists. He'll probably still be ducking the cold, deep in his winter's nap.

Western version of the woodchuck rarely is seen before April.

The original folk tale, brought to this country by the Pilgrims, was based not on the woodchuck at all, but on another animal: the European hedgehog. Over the years, however, the chuck replaced the hedgehog in the story, and took over its dubious role as a weather prophet.

But though the chuck is no good at predicting the weather, Dr. Lyman believes he has a lot to tell us about how he adjusts to it.

Man, a warm-blooded animal with a normal body temperature about the same as the woodchuck's, has two choices in winter: He can go to Florida, or he can shiver it out.

The woodchuck can do something else: He can hibernate. He can curl up into a ball, lower his body temperature to a few points above freezing, reduce his heartbeats to eight or nine a minute, cut down air intake to an average of one breath a minute, and live quietly, for many weeks, without eating.

If he must answer a call of nature, he usually wakes; if it gets too cold, so that he is in danger of freezing to death, he also wakes. In the process, he warms himself up. What wakes him, or what puts him into hibernation in the first place, is not known. It may be the hypothalamus, an area in the brain above the pituitary that influences many bodily processes, including sleep.

It is the woodchuck's amazing ability to adjust to the weather that makes him so important to science. "If you can carry your internal environment around with you," says Dr. Lyman, "you can go anywhere. Warm-blooded animals like man can live in a wide variety of temperatures. The snake can't. The frog can't. This warm-bloodedness is quite a stunt."

But the woodchuck can go even further. Says Dr. Lyman, "When the climate is too cold he can abandon his warm-bloodedness. He's even more freed from dependence on temperature than you are."

Thinking of the great cold in outer space, and of future long interplanetary trips (possibly 30 years to Neptune, five or six years to Saturn), he says:

"If we had to go a great distance in space, I would think hibernation would be the way to do it."

The notion is intriguing. A hibernating hamster, for instance, uses only 1/30 to 1/50 of its normal energy, and needs correspondingly less food. Food and oxygen storage requirements in a spaceship could be enormously reduced—if its passengers learned to hibernate.

The Air Force thinks there may be something in the idea; it has supported some of Dr. Lyman's experiments. During World War II, in the Army Air Corps, Dr. Lyman did research in high-altitude medicine. After the war, his research led him into making the acquaintance of three hibernators: the woodchuck; its cousin, the 13-lined ground squirrel (named for its stripes); and the golden hamster.

In one of the big gray buildings of the

CONTINUED

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Harvard Medical School, Dr. Lyman keeps these animals, today, in small wire cages similar to those that schoolboys use for their pet hamsters. His room is different, though: It is cold, with a temperature around 40 degrees.

If hibernation is to be of service to man, scientists must learn how to induce it. Dr. Lyman tries to put his animals into hibernation. "We give them food (grain), water, and bedding (wood shavings). Then we wait," he says. "If we're lucky, they hibernate." Some don't; others hibernate only after a long time. What triggers hibernation is unknown. A possibility, which some investigators are exploring: that the chucks and other animals secrete an enzyme or hormone that causes them to hibernate. There is only one thing Dr. Lyman is sure must be present to cause deep hibernation: cold.

What do animals do in hibernation? The answers vary. The hamster eats. He lays in a great supply of grain, and wakes often (once a week or so) to nibble and if possible drink water.

The woodchuck follows a different scheme. Before hibernation, he eats and eats till he weighs four times as much as he normally does, and he balloons out till he's almost basketball-size. Even though he wakes every three weeks or so, and may even spend half a year or more in hibernation, he eats nothing during that period.

The ground squirrel follows a middle course—he fattens in advance, and also wakes to eat.

The legend of the woodchuck seeing his shadow is not the only folk tale Dr. Lyman has demolished. A few winters ago, he achieved a kind of fame in New England when he pointed out, to the dismay of woodsmen and hunters, that bears do not hibernate.

The winter was cold, and woodsmen were surprised to see bears wandering around.

"There's no reason why they shouldn't be," Dr. Lyman told newspaper reporters who questioned him.

Letters to editors poured in.

"What I had done," he says, "was attack the legend that bears hibernate throughout the winter. This was like shooting Santa Claus."

Then (shooting Santa Claus really dead) he went on to say that the bear is simply a deep sleeper. It reduces its body temperature only slightly, not to just above freezing. It wakes often, and eats if it can. It wakes very quickly. A way to test this, which he does not advise, is to poke a bear you think is in hibernation.

HIBERNATION SPECIALIST: Dr. Charles P. Lyman sees possible answers to many problems in chuck's winter sleep.

His hibernating chucks and ground squirrels, on the other hand, take two to three hours to awaken. Poking or handling them can start the slow waking process, but does not necessarily do so. In hibernation, they are cold and rather stiff to the touch, and move only slowly and sluggishly. The hamster appears to go deaf. It is not awakened by loud noises.

As the woodchuck wakes, his body temperature rises from about 37.4 degrees to normal, around 98. He produces heat at a tremendous rate as his metabolism speeds up. His heart, after two hours, is beating 200 times a minute —against a normal 80—faster than it does any other time in his life. His breath comes faster, too; from one a minute, in hibernation, he speeds up to much more than the normal 25 to 30 gulps a minute, before slowing down.

In two or three weeks, in spite of the half-year drain on his fat, he's ready to start a family. He breeds in the spring, and in early summer woodchuck families, with five cubs or so, begin to appear.

Then, in September or October, after growing fat, woodchucks young and old hibernate. They hibernate alone or in pairs. For their deep sleep, the chucks prepare long (10- to 25-foot) burrows, with side tunnels sloped for drainage, and often emergency side entrances that are observation posts against enemies.

What science can learn about hibernation may have other applications for man besides space travel:

- Surgery. By means of a technique

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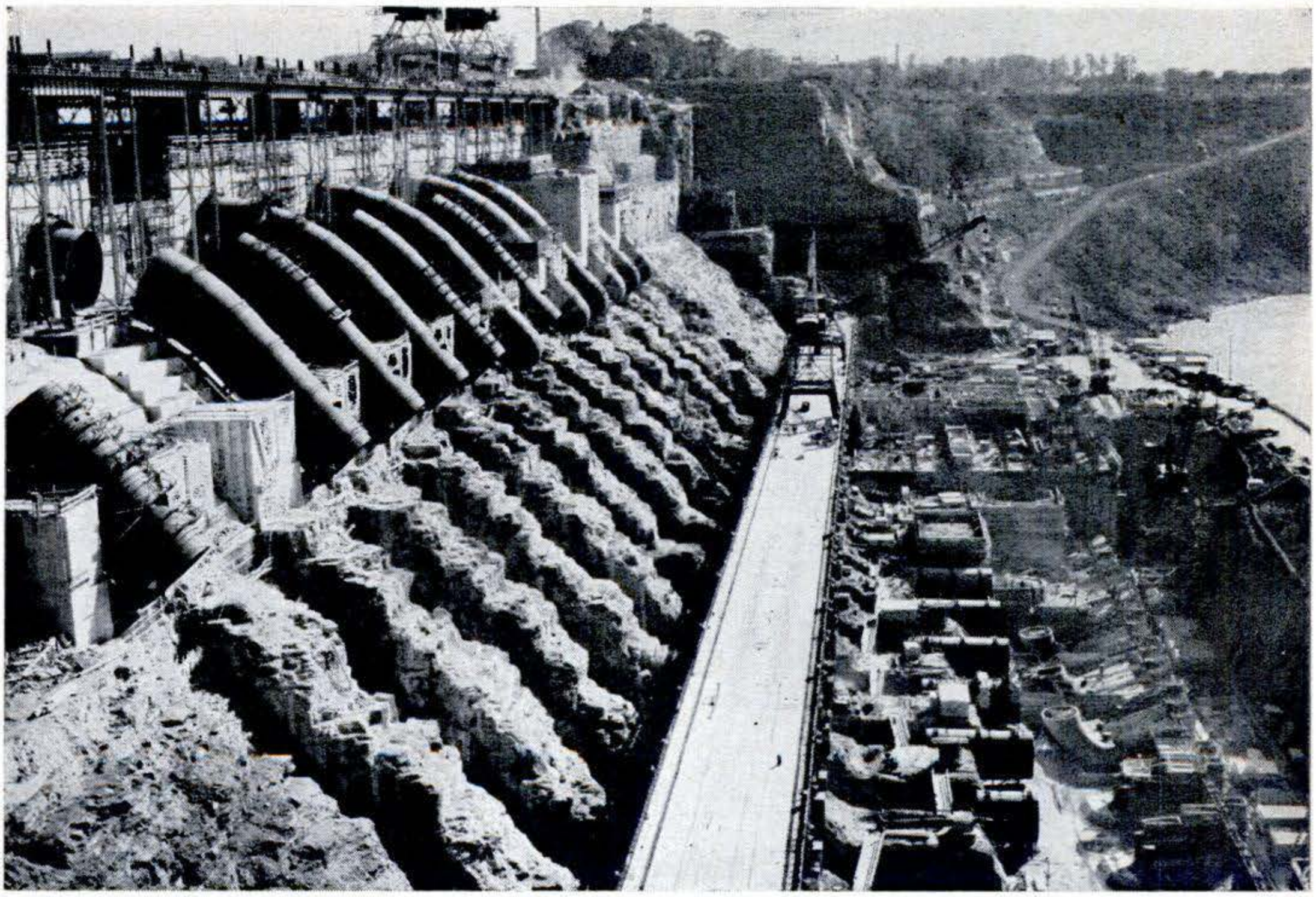
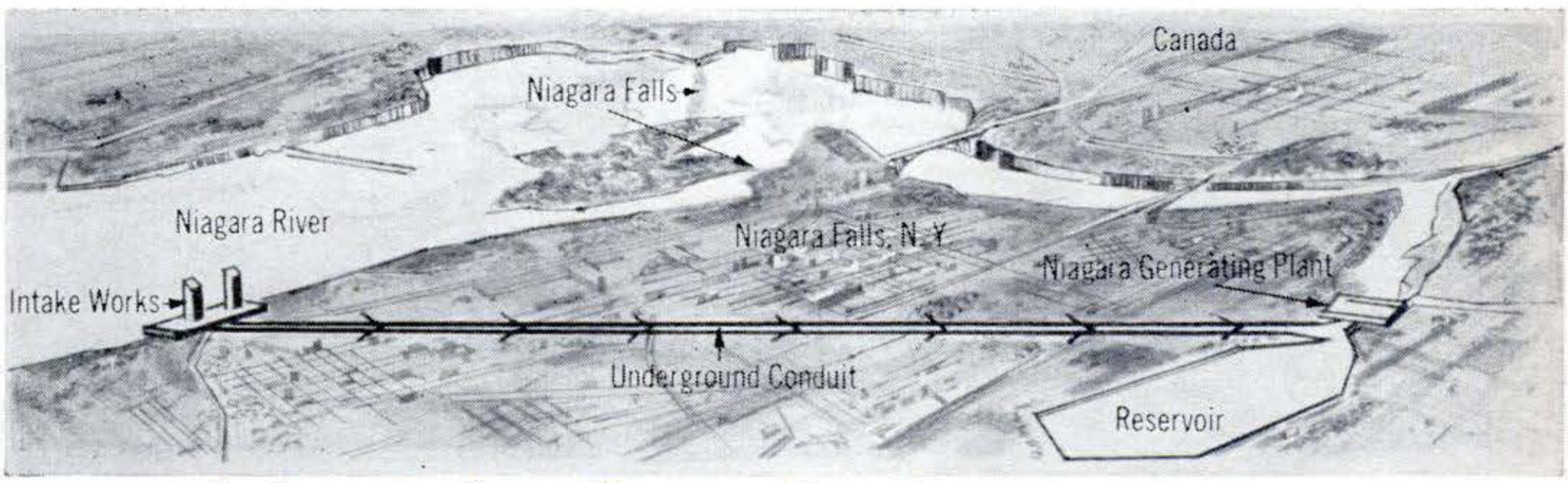


THIRTEEN PENSTOCKS—one for each generator—will channel Niagara's water. The generators (to be installed at right in photo) will be the largest ever built—150,000 kw. each.



From an intake three miles above Falls, water will flow through four miles of covered conduit.

TAPPING NIAGARA FOR MORE POWER

Greatest single hydroelectric power project in this hemisphere, the Niagara generating plant under construction above will have an installed capacity of 1,950,000 kw. With nearby smaller Tuscarora, the project will provide 2,190,000 kw., topping even Grand Coulee. Water from the Niagara River will bypass the city in underground conduits. Restrictions will preserve the Falls' beauty.

TWIN TARGETS. Two Ryan Firebee jet drones are under the wings of this B-26 taking off at Tyndall Air Force Base, Fla. The second is for assurance that at least one target will be on range for missile practice by fast interceptors.

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Atomic energy will heat, light, and power this modern community being carved out below Greenland's vast snow top— 800 miles from the North Pole

RAMP ENTRANCE of compacted snow will provide access for heavy snow vehicles. Doors will be overhead garage type. Blast in the background is from an under-snow explosive charge.

CUT-AND-COVER PROCESS starts with a shallow trench. Guide rails in walls insure that snow plow will follow correct line and grade. Here the guide platform is being adjusted.

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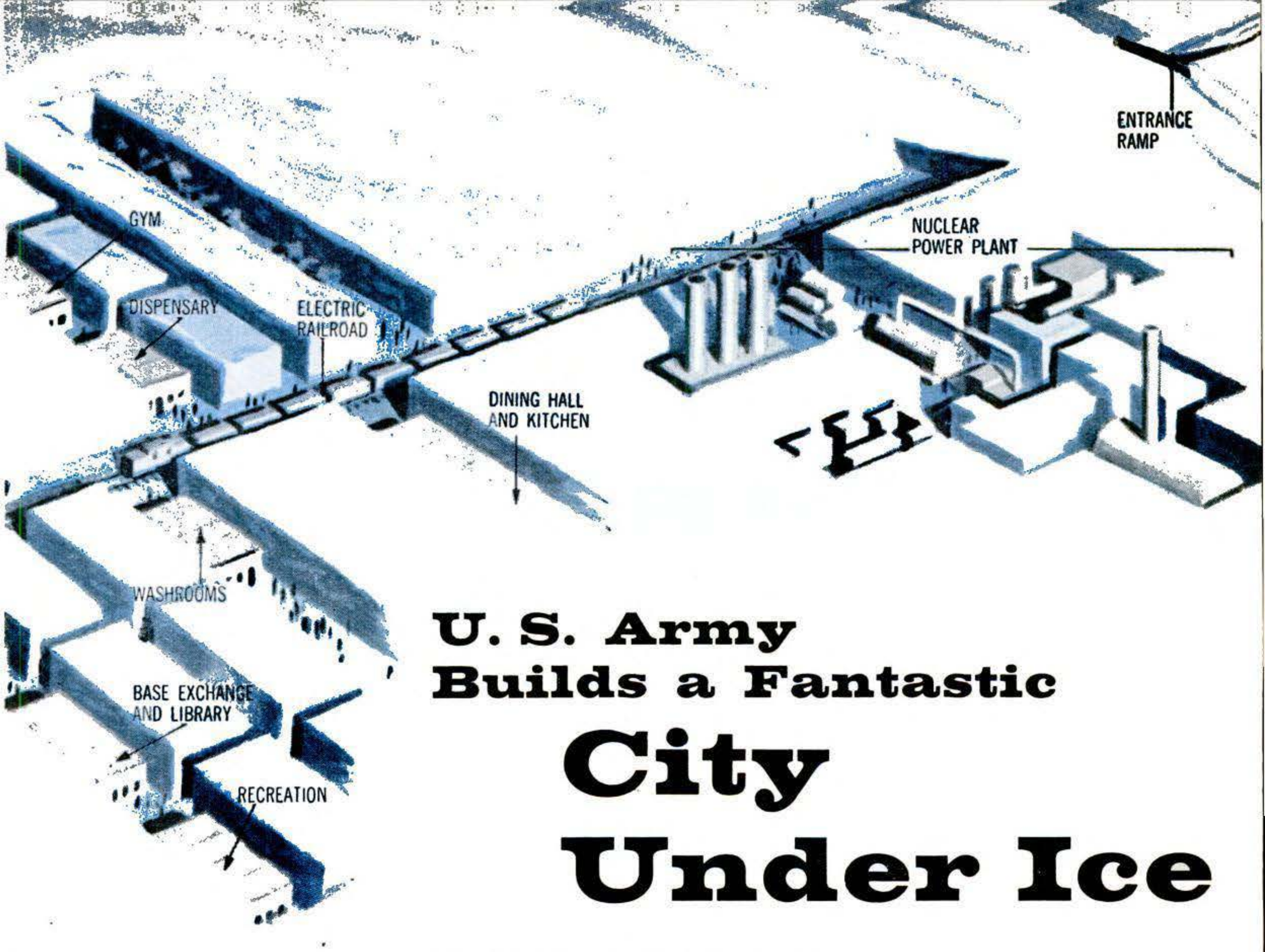
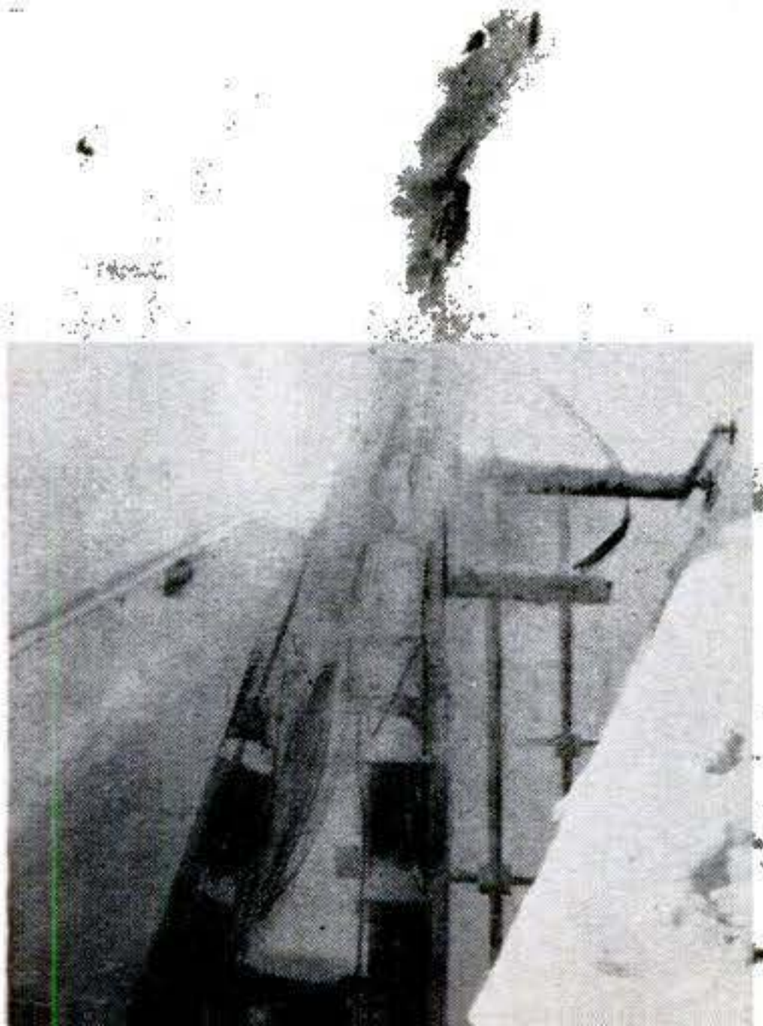


U. S. Army Builds a Fantastic City Under Ice

By Herbert O. Johansen

THE strangest boom town in the world is being built by Army engineers under Greenland's vast icecap. Completely hidden by snow, it will be powered by atomic energy—and will be about as safe a place as you could find in case of atomic attack. It would be hard for an enemy to find; and snow would absorb much of the shock of an atomic blast, and partially shield the occupants from radiation and fallout.

PETER SNOW MILLER, attached to guide platform, cuts deeper with each pass, down to a depth of 24 feet. When finished, Camp Century alone will have more than six miles of tunnel.



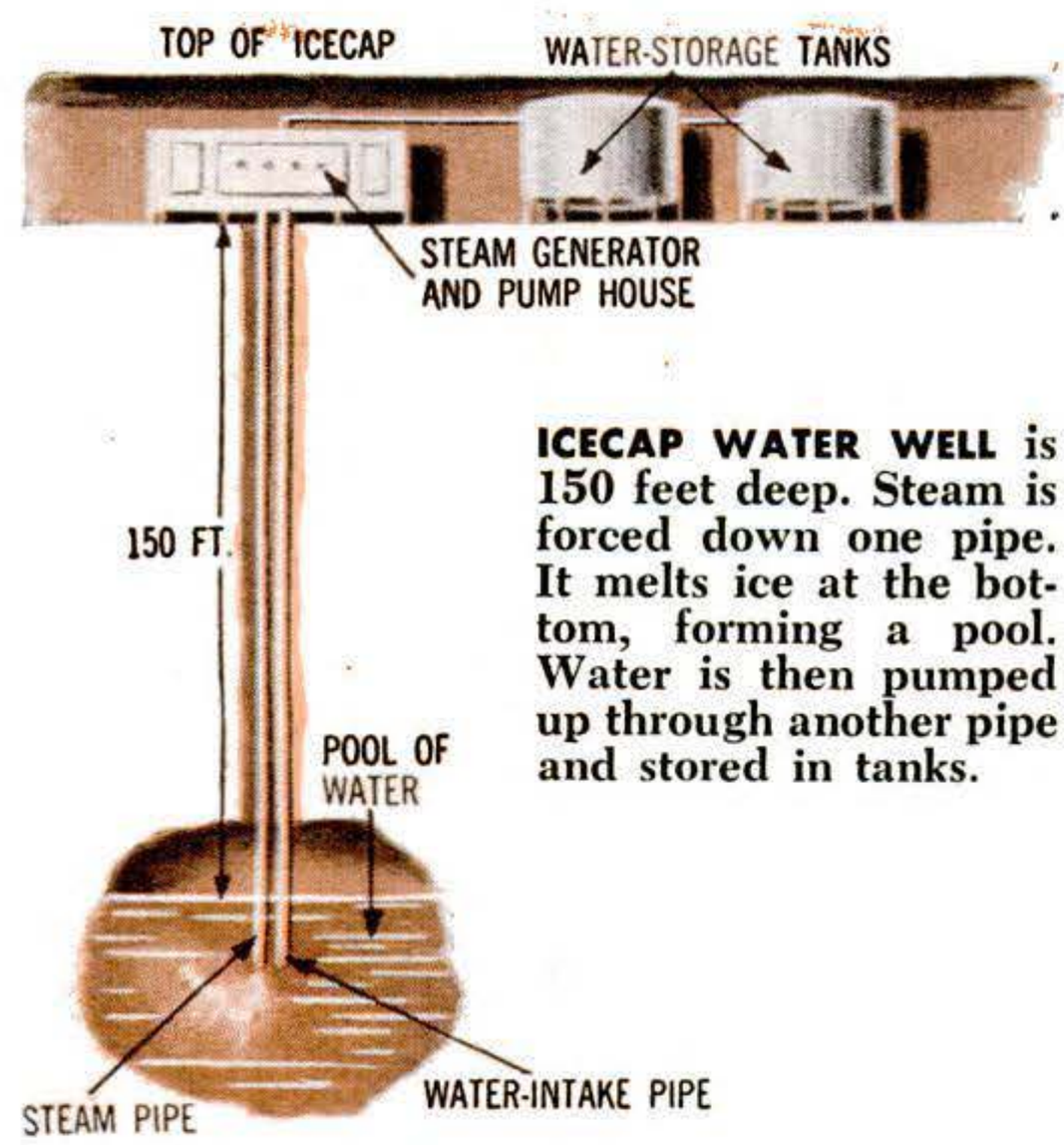
CORRUGATED METAL STRIPS form a temporary roof, after cut has been made. Powdered snow, blown back over it, hardens fast. Metal forms are then removed from inside and used again.

CONTINUED

FOUNDATION IS LAID for the first Camp Century under-the-snow building. Work on the icecap was halted last September by Arctic winter. Construction will be resumed in May.

RADIANT HEAT, with electricity supplied by a nuclear power plant, will keep the buildings comfortably warm. Here you see the heating wire being installed between floor ribs.

HARD WAY OF GETTING WATER in Arctic is by melting snow. Camp Century way is shown below.



ICECAP WATER WELL is 150 feet deep. Steam is forced down one pipe. It melts ice at the bottom, forming a pool. Water is then pumped up through another pipe and stored in tanks.

In building the fantastic community, 800 miles from the North Pole, Army Engineers, in cooperation with the Danish Government (Greenland is a part of the Kingdom of Denmark), have proved that the traditionally antagonistic Arctic can be tamed.

An electric railroad running through a tunnel cut in the snow will connect the town with the supply base at Thule Air Base 152 miles to the west. For air supply there will be landing strips of compacted snow for the largest cargo planes, and landing pads for helicopters.

It will be home—snug, comfortable, and warm—for 100 scientists, engineers, and soldiers who are expected to move in late this year. After a hard day's work they will be able to relax with tall drinks cooled by deep-dug ice that was formed long before Columbus discovered America.

It is Camp Century—a year-round haven for the men who will study problems of living, working, or fighting in one of the world's harshest environments, where winter temperatures drop to 70 below zero and winds whirl snow in a blinding fury at 100 miles an hour. With previous shelters, the open season was limited to five months—May through September.

Now the men will live and work in a series of insulated prefabricated buildings connected by snow corridors. Cumbersome Arctic clothing—parkas, bulky mittens, mukluks, scratchy woollies—won't be needed even in the work areas,

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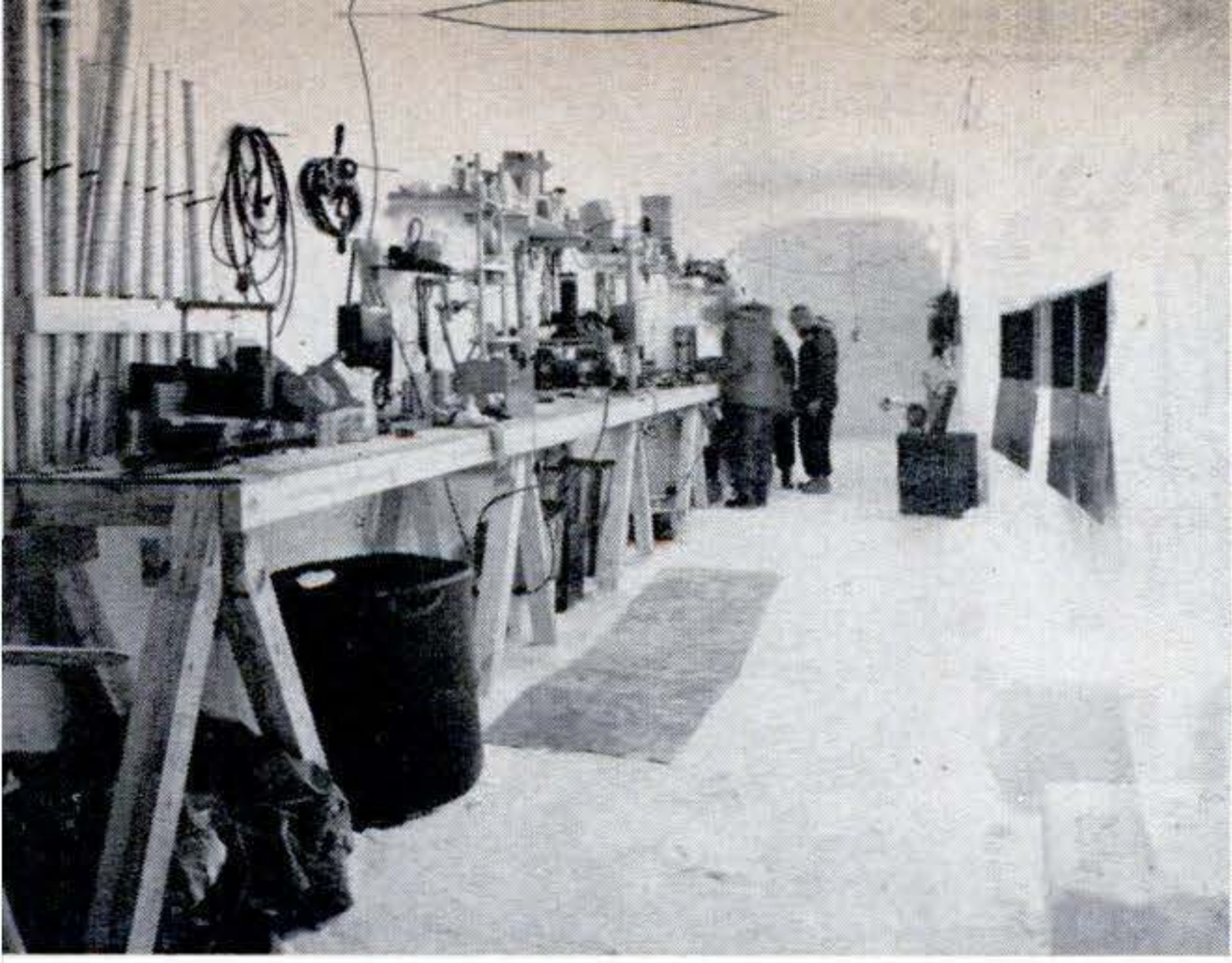

IN A TEMPORARY CAMP, scientists wore Arctic clothing and worked under rugged conditions in this crude laboratory. In Camp Century labs, they'll hardly know they left home.

AN ICE CORE IS CAREFULLY REMOVED from a drilling barrel. Study of such icecap samples, recovered from thousands of feet down, will be a year-round job for the scientists.

where the temperature will be kept at 40 degrees. It will be upped to 60 degrees in living quarters. A ventilation system will exhaust warm air from the tunnels to keep the snow walls at 20 degrees or below so they won't melt. To prevent the snow floor from becoming slush, the buildings will be raised slightly to permit a circulation of cold air underneath.

Life in Camp Century. The inhabitants will never see daylight unless they venture outside. But during the worst months of the year—December and January—that won't matter: The sun never rises.

At first glance the unnatural life within the confines of a buried snow town—four blocks long, and three blocks wide—looks forbidding, depressing, killing in its monotony. It would be if a man didn't keep busy and have cheerful surroundings, and facilities for recreation.

Here the residents of Camp Century will score on all points. They will be busy at their jobs—from cooking to researching—eight to 10 hours a day. After that it's up to a man's individual taste. There will be a recreation hall and game rooms, a gymnasium, a hobby shop. A library will share quarters with a Base Exchange.

Movies will be shown every night. Television programs will come from the military TV station at Thule. Radios will tune in perfectly on Radio Moscow across the Arctic. Eating will be in a clublike dining room. Food will be the best (with an extra half ration to compensate for faster-burned-up calories) and steak will be in plentiful supply.

Spacious dormitories will replace double-down, zip-up sleeping bags; hot and cold showers the occasional lick-and-promise basin bath. A laundry and a barber shop will keep the outer man clean and neat; a 10-bed hospital with an operating room, the inner man in repair. A chaplain and chapel will serve spiritual needs.

Only one comfort of man—beyond the scope of the Army—will be lacking. It is hoped that fast air mail, ham radio-telephone chats with wife and family in the United States, and rotating four-

[Continued on page 229]

ALL THE COMFORTS of a stateside base—except weekend passes—will be offered. Base Exchange facilities (shown here at a temporary site) will be duplicated at Camp Century.

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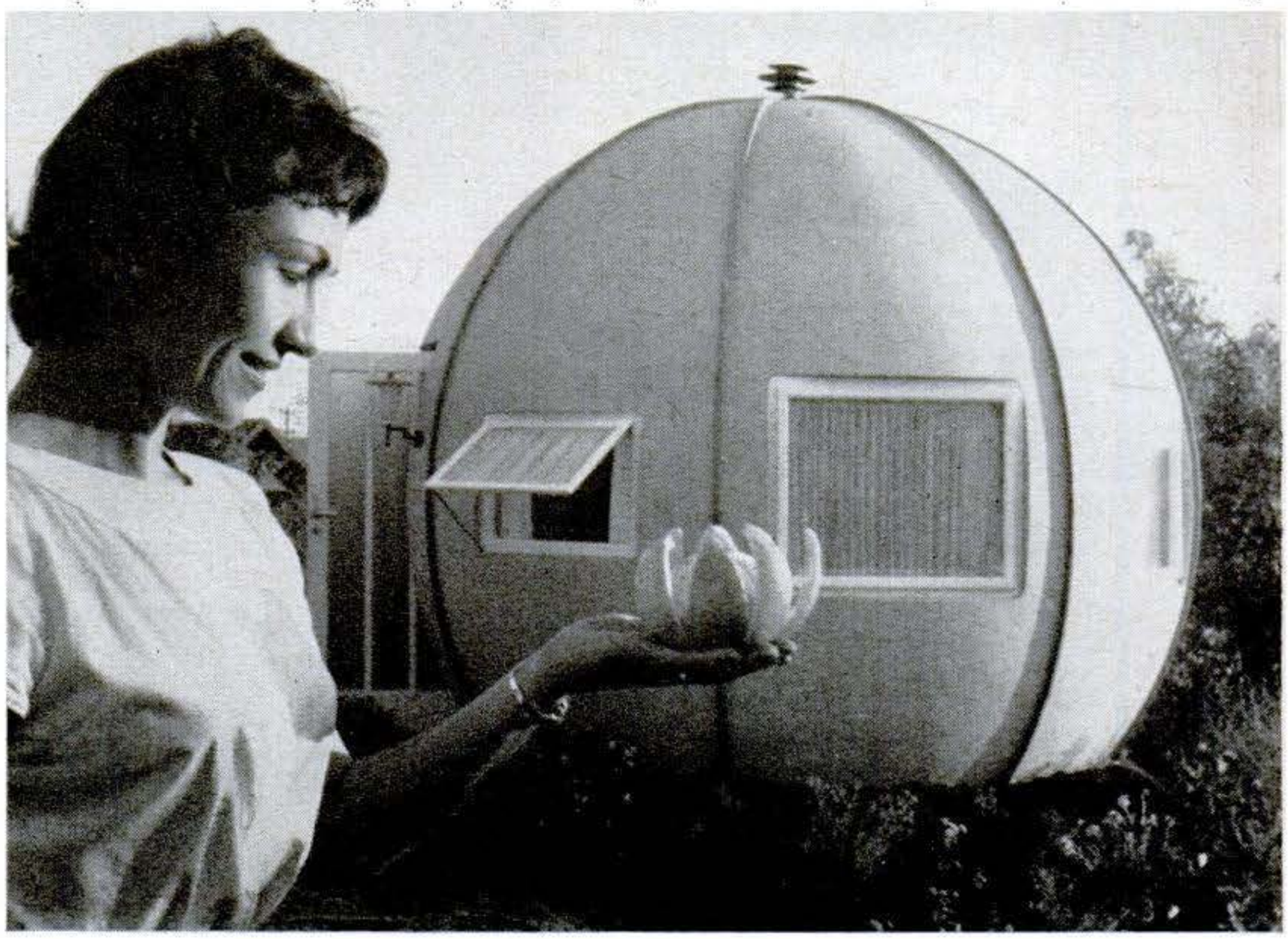
HOUSE BUILT LIKE PUMPKIN

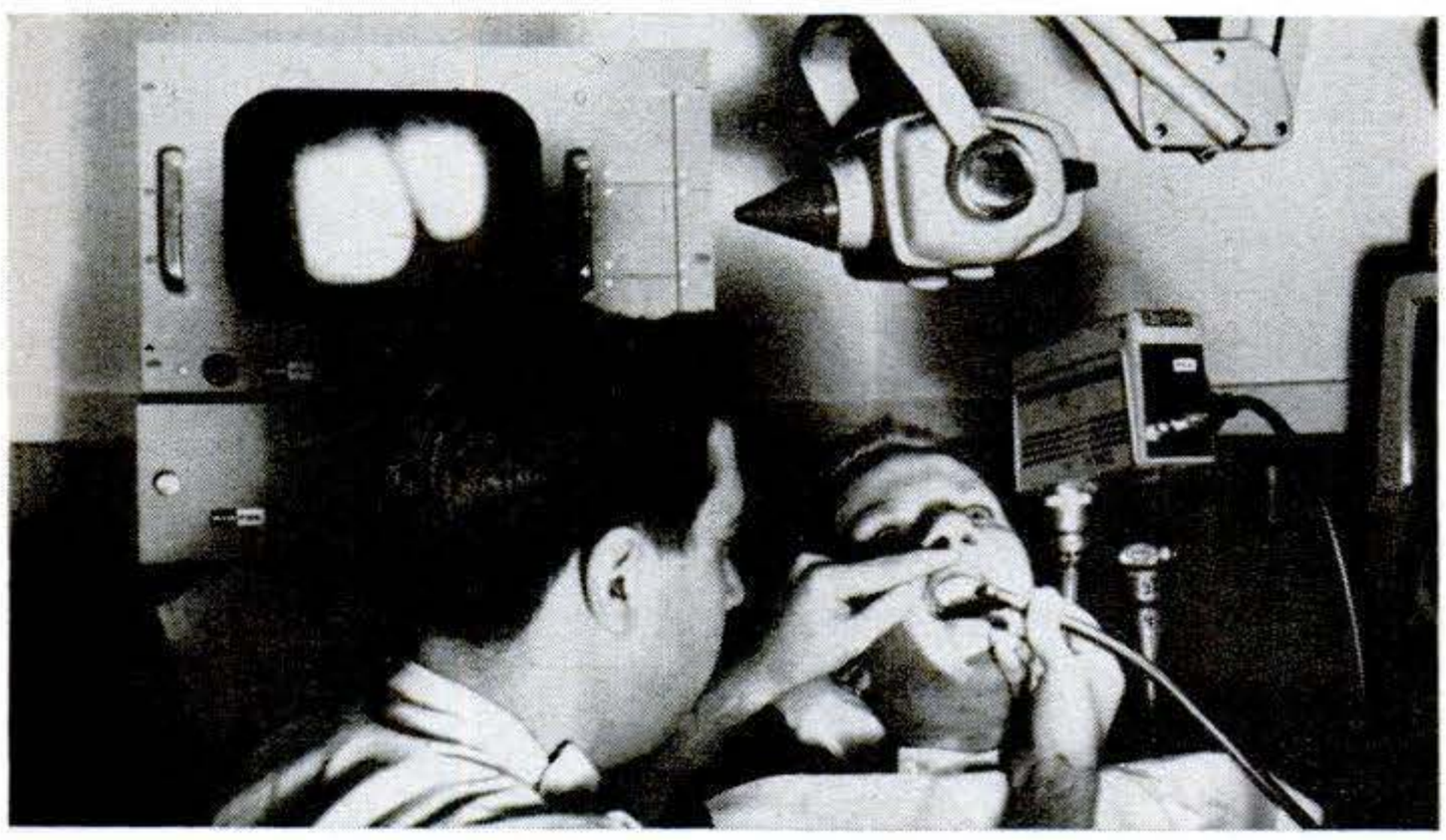
The plastic shell of this little spherical house is assembled from eight segments. It can then be set in a shallow hole or propped behind low plantings in a garden or at a camp site. Joints are sealed with plastic strips.

Inside its 13-foot-diameter shell are three rooms: a combination living room and bedroom, kitchen, and lavatory. The space under the floor is a storage cellar.

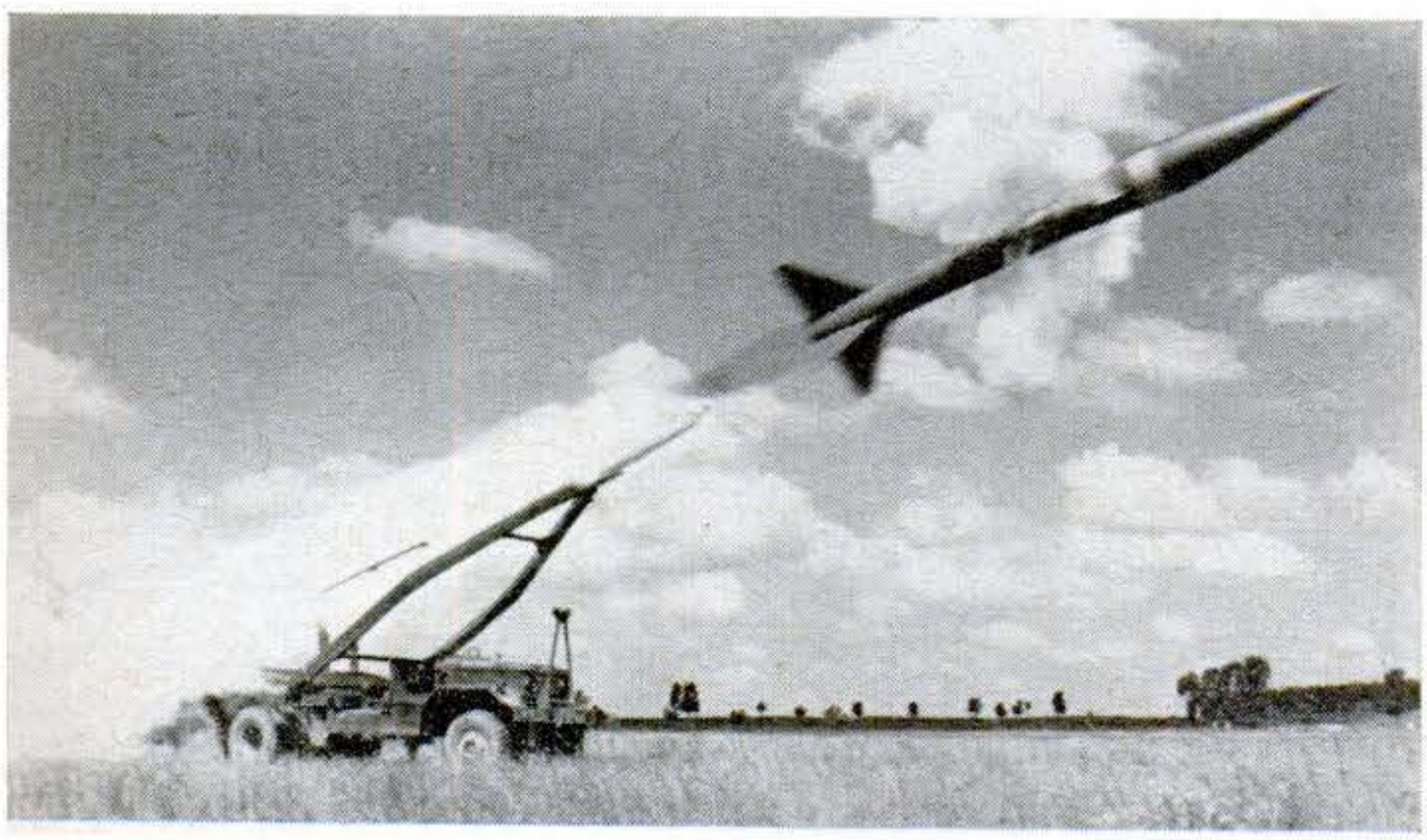
The house was designed by a West German automotive engineer who builds trailers for campers.



Segments are put together like the skin of a peeled orange.



DENTAL TV. The instrument used by the dentist at left gives him an enlarged picture of a patient's teeth on the TV screen at rear. It's a probe consisting of some 10,000 hairlike optical fibers. Each fiber picks up the light ahead and transmits it to a closed-circuit TV camera coupled to one end. Avco Corp. developed it for the Navy, sees use for it in exploring body cavities.



NEW LAUNCHER. The Army now puts its Honest John missile into flight from the back of a truck. This gives it more mobility than the artillery's biggest guns. The rocket—which can carry an atomic warhead—is hoisted onto the launcher by crane from its carrier and can be transported on it for short distances. Leveling jacks on the truck chassis permit firing from steep slopes.

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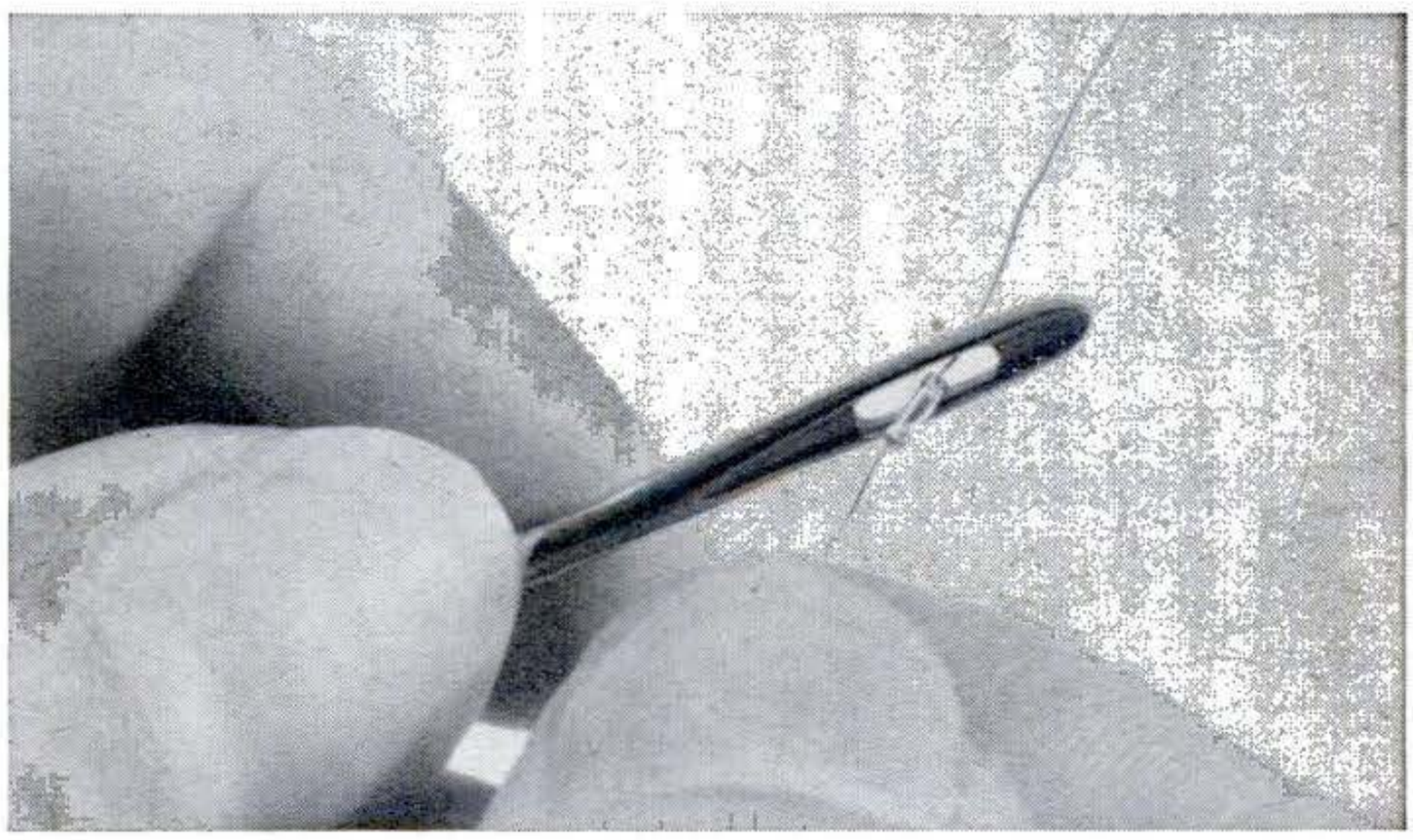
TINY KITCHEN is just big enough for a range, refrigerator, sink, and shelves.

TILED LAVATORY has modern fixtures that add a touch of home life to camping trips.

SHALLOW CELLAR, reached by trapdoor, is a segment of the sphere under the floor.

TINY LAMP. The incandescent bulb being pushed through the eye of a darning needle at right is the smallest ever made on a production line. It has been named the Mite-T-Lite by Sylvania and is for use in transistorized circuits in missiles, computers, and electronic systems. It operates on 1.5 volts, has a tungsten filament, and is .040 inches in diameter and .125 inches in length.



MOVING TOWER. This 120-foot smokestack is being hauled to the site of a British oil refinery on two separate trailers. The forward part of its 40-ton weight rests on a trailer pulled by one truck; the rear end is on another coupled to and steered at corners by a second truck. The third truck is a spare—for aid in towing upgrade and for added braking power when going down.

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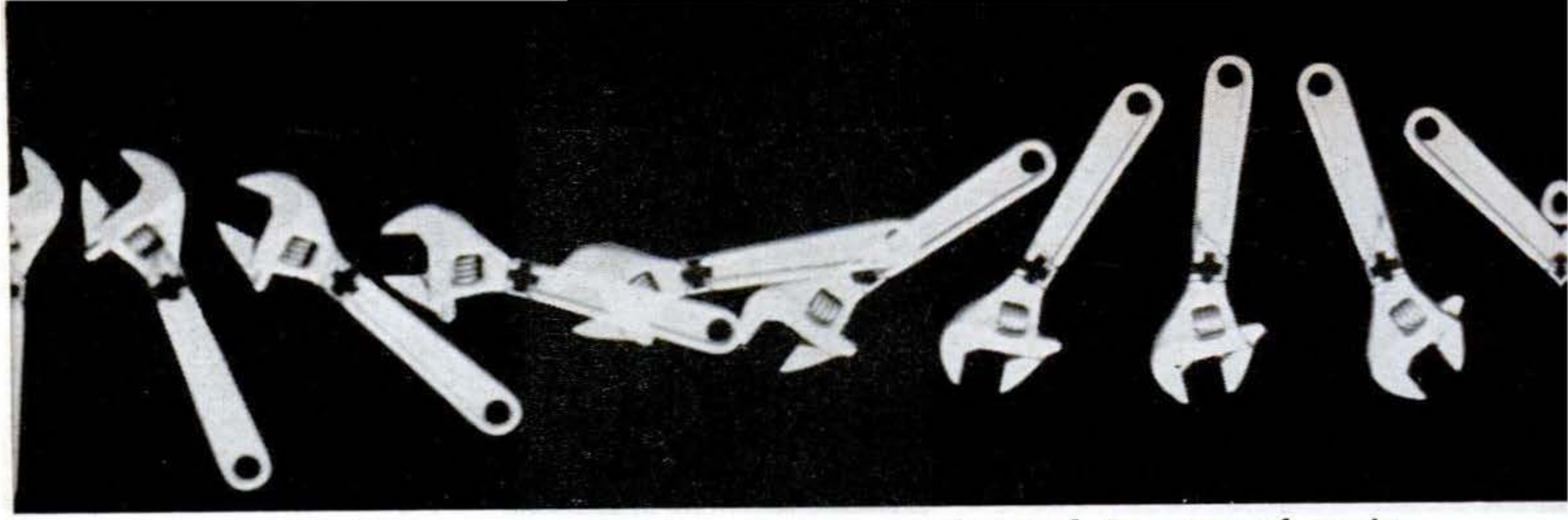
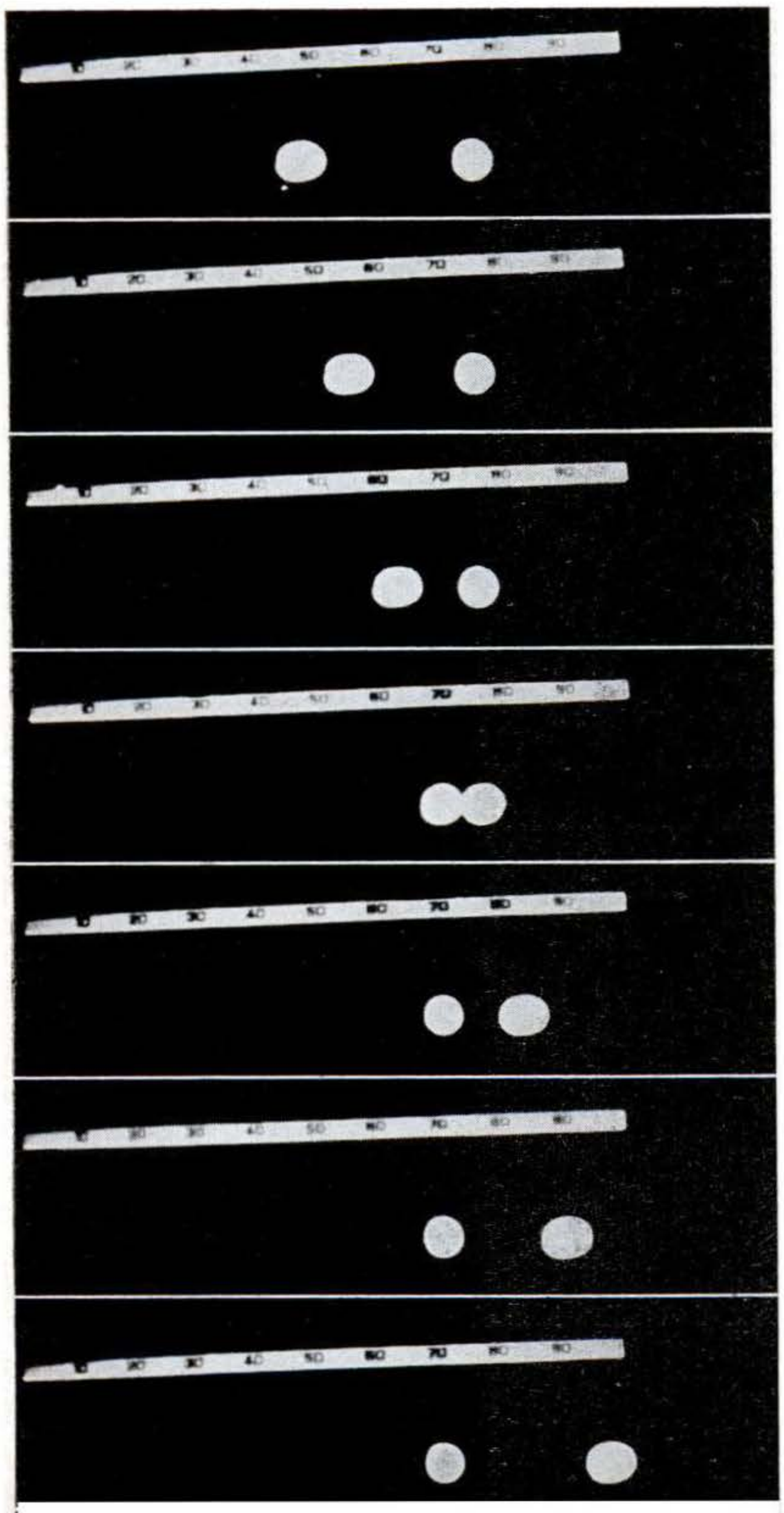


NOT-SO-WILD FLIGHT: The wrench seems to tumble erratically—but put a ruler along the black crosses that mark its center of gravity. The CG goes in a straight line and at unchanging

Camera Catches Laws



PHYSICS can be beautiful—when a master photographer like Berenice Abbott dramatizes the laws of nature on film. These striking strobe sequences are illustrations for a new textbook now being tested in many high schools and soon to be published by D. C. Heath. It is part of the revolutionary physics course, which includes teacher's manuals, experiments, lab equipment, movies, and even outside-reading books, developed by Educational Services, Inc.

The photos hammer home the main theme of the new course: that true knowledge comes from accurate reasoning about nature as it is, not from common-sense assumptions about the way things ought to be. Quite often—as the pictures prove—plain common sense is plain wrong.

BILLIARDS AND ROCKETS: When one billiard ball hits another head-on, the first stops and the second goes off with the speed of the first. If the second had been heavier, it would have moved off more slowly—momentum (velocity times mass) stays the same. Rockets work that way, too: Backward momentum of exhaust gases matches forward momentum of the rocket.

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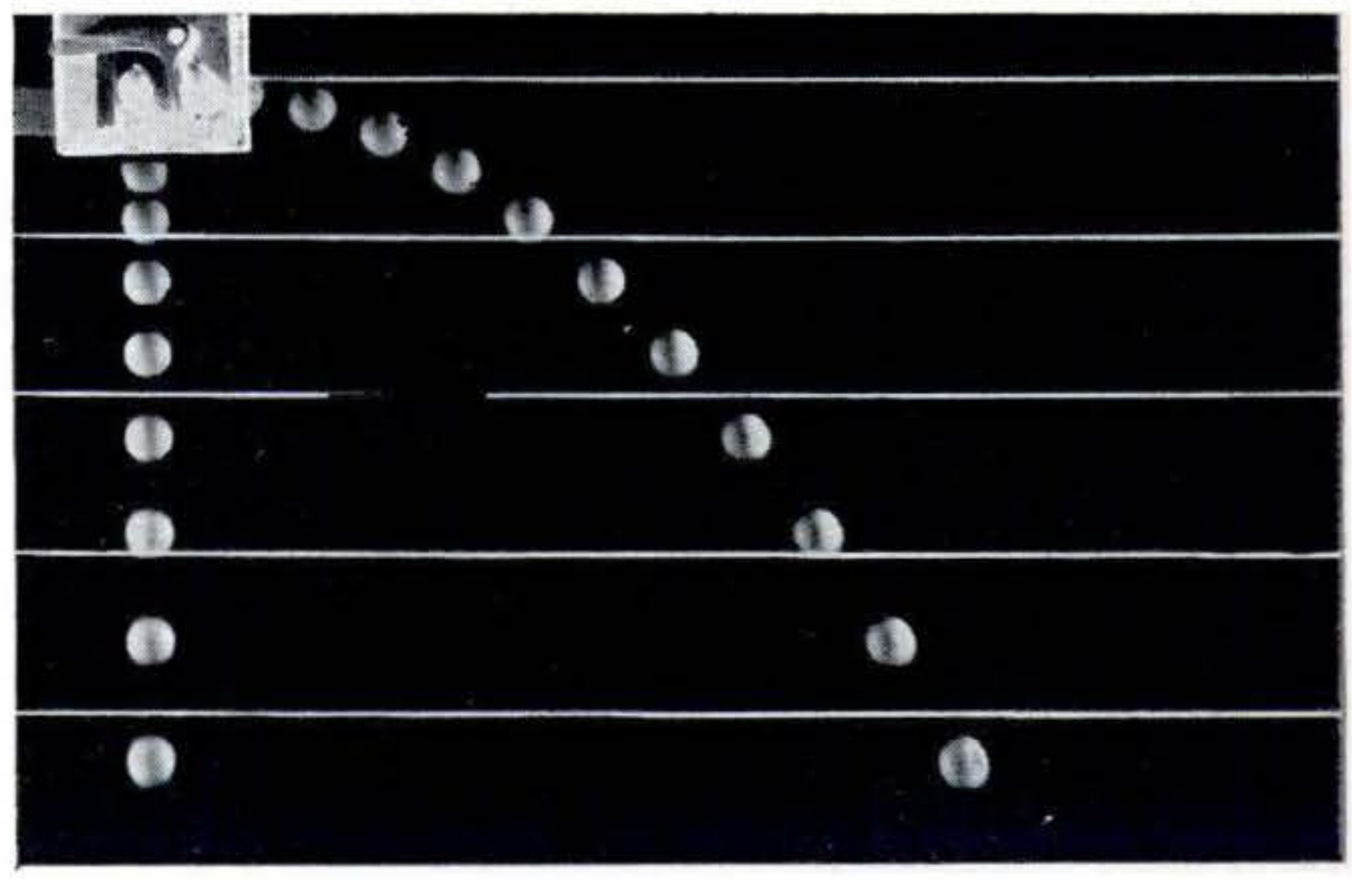
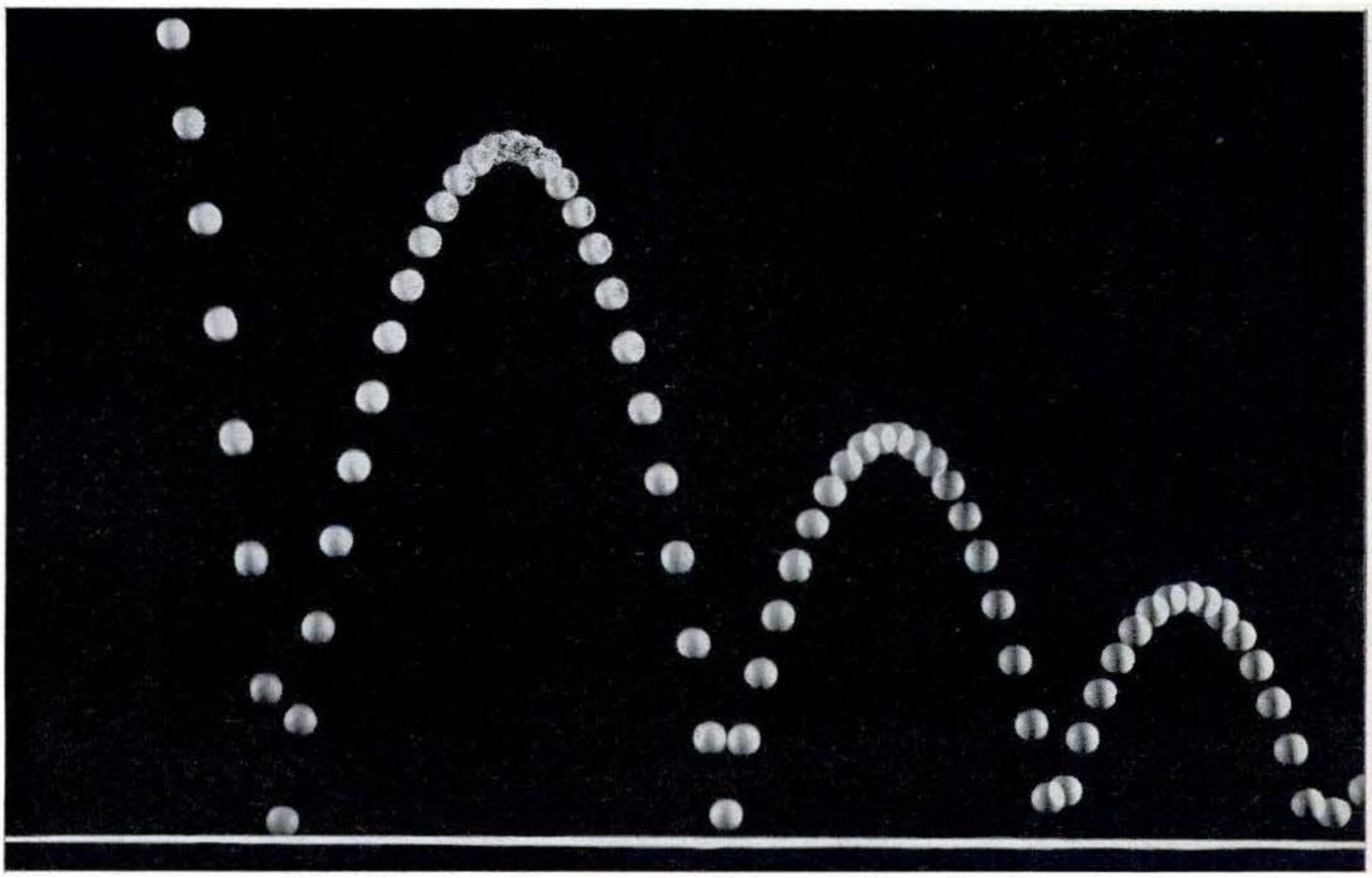
speed (the spaces between crosses are equal). That's what Newton said: When no forces are acting, a moving object continues forever to move in a straight line and at a constant speed.

# of Nature

WHICH HITS GROUND FIRST? A bullet fired from a gun falls to earth at exactly the same time as one dropped from the gun's height, unlikely as that seems. (The demonstration here uses golf balls.) Galileo figured it out: Horizontal acceleration of an object (from the gun blast) has no effect whatever on vertical acceleration of the object caused by gravity.





ENERGY FOREVER: The ball moves slower and lower with each bounce because it loses energy. But the energy isn't lost—it has been transferred inside the ball and the floor plate to make their invisible molecules move faster. The fact that energy cannot be destroyed (or created) is one of the few absolutely positive laws of science—no exceptions, ever.

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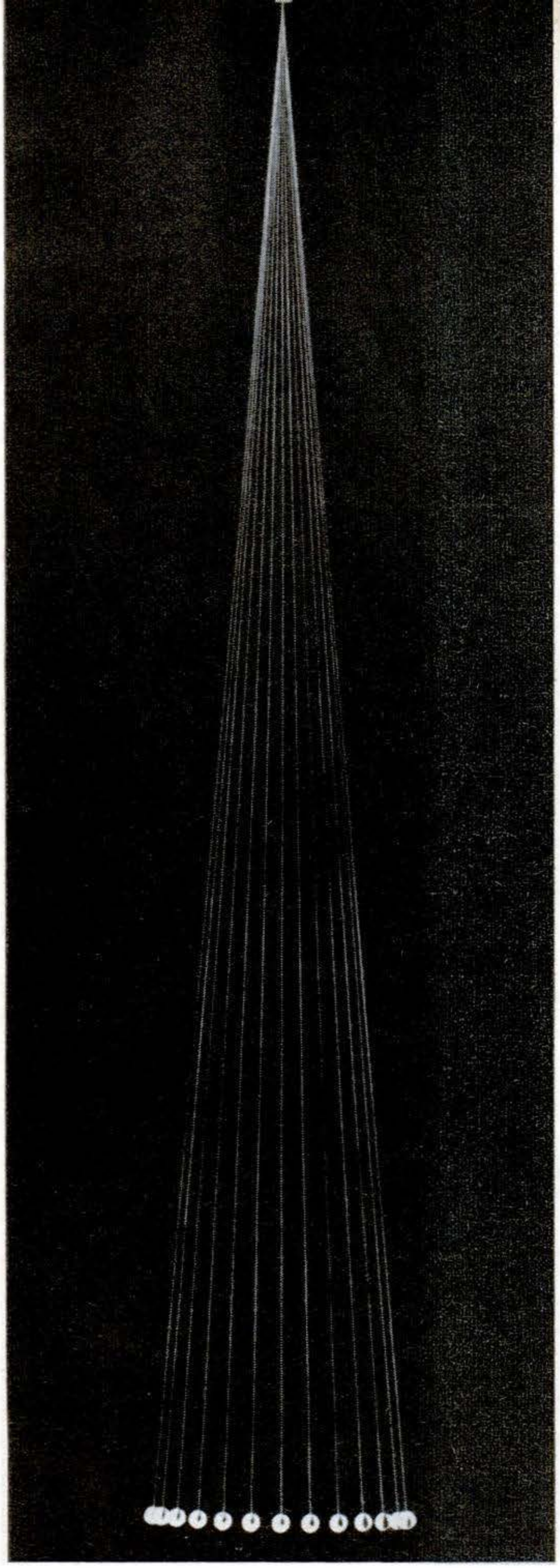
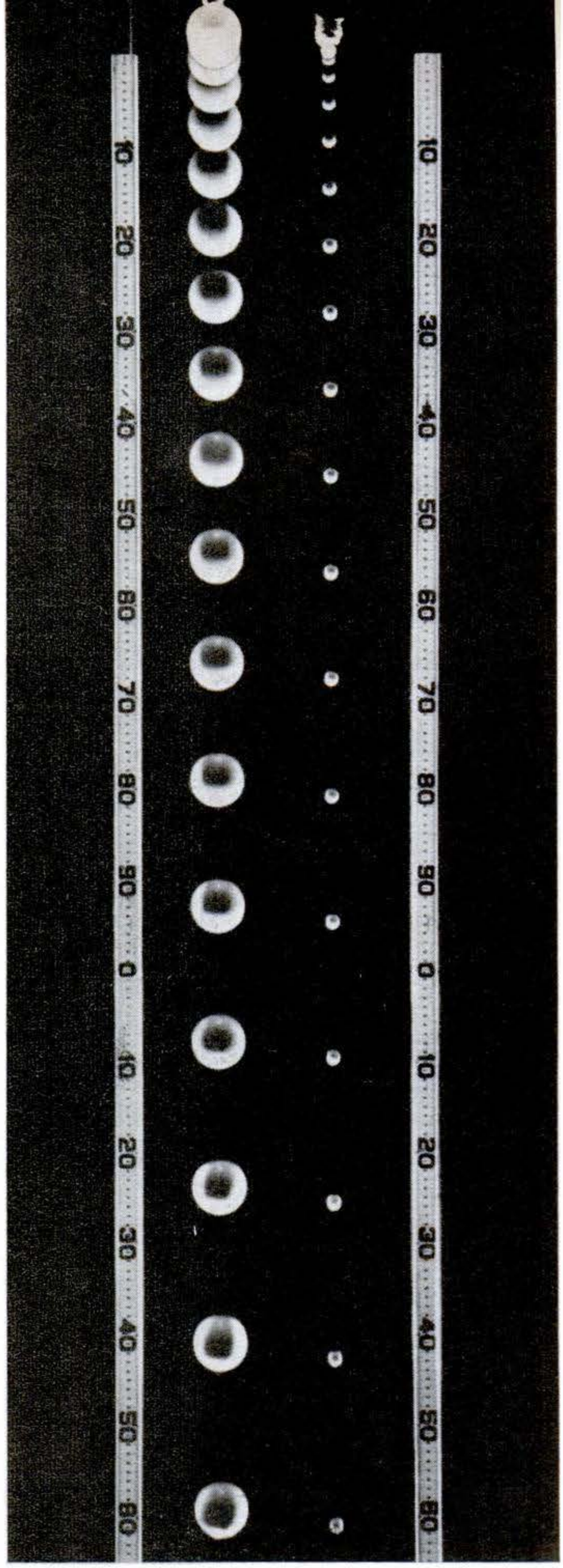


CONSTANT PENDULUM: This ball swings through a foot in one second. Longer arcs—or shorter ones—take exactly the same time. It's another violation of common sense that Galileo spotted (he was timing—with his pulse—swings of a hanging lamp in Pisa Cathedral). Explanation: On longer swings, the ball falls a greater vertical distance to move faster and keep on time.



GALILEO IS RIGHT: It's obvious common sense that a heavy object has to fall faster than a light one. Only it doesn't. The billiard ball (left) and the light steel ball (right) stay precisely together all the way down in this sequence photo. Einstein pondered this strange fact of nature, and made it a cornerstone of his complex explanation of the force of gravity.

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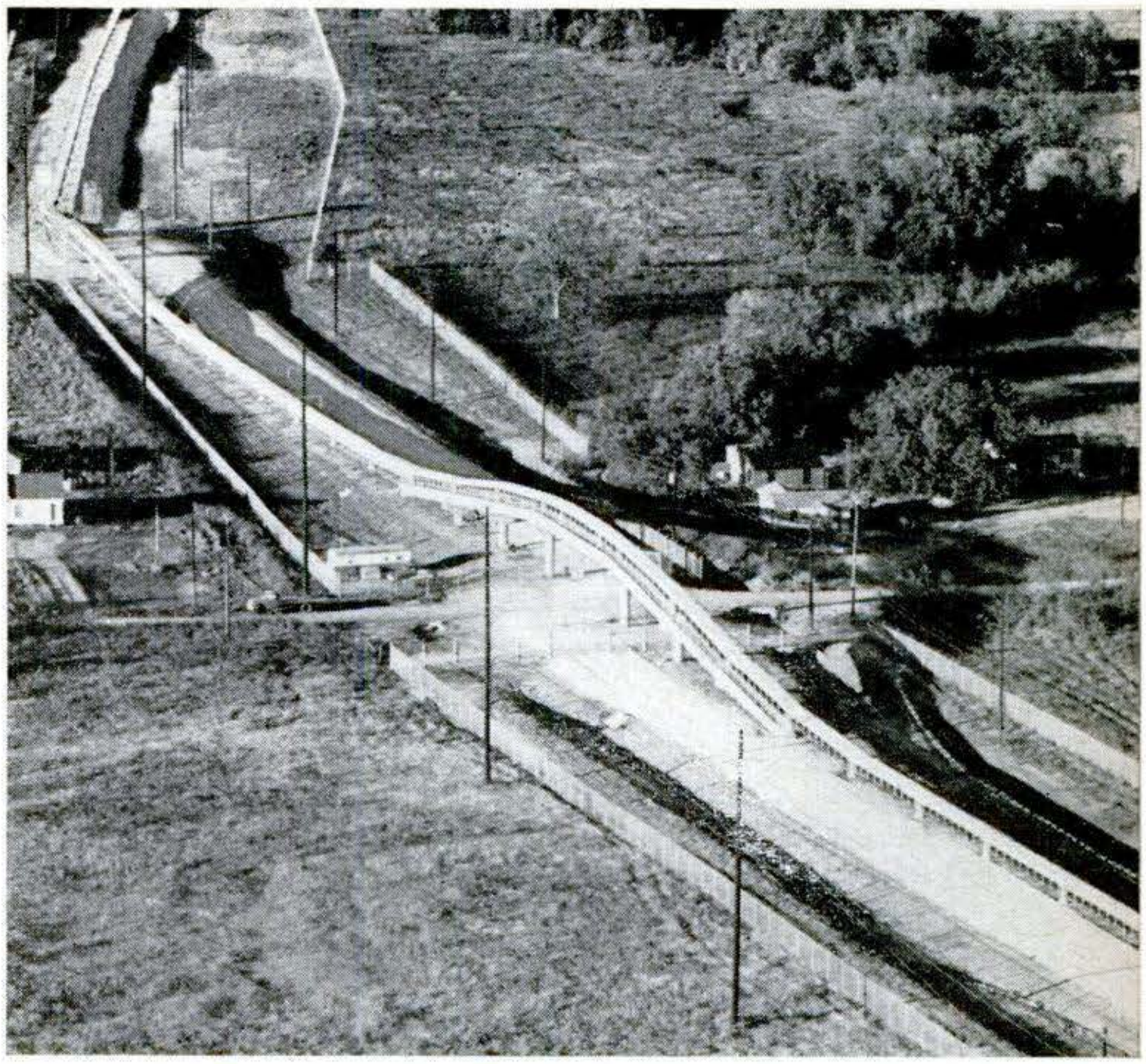
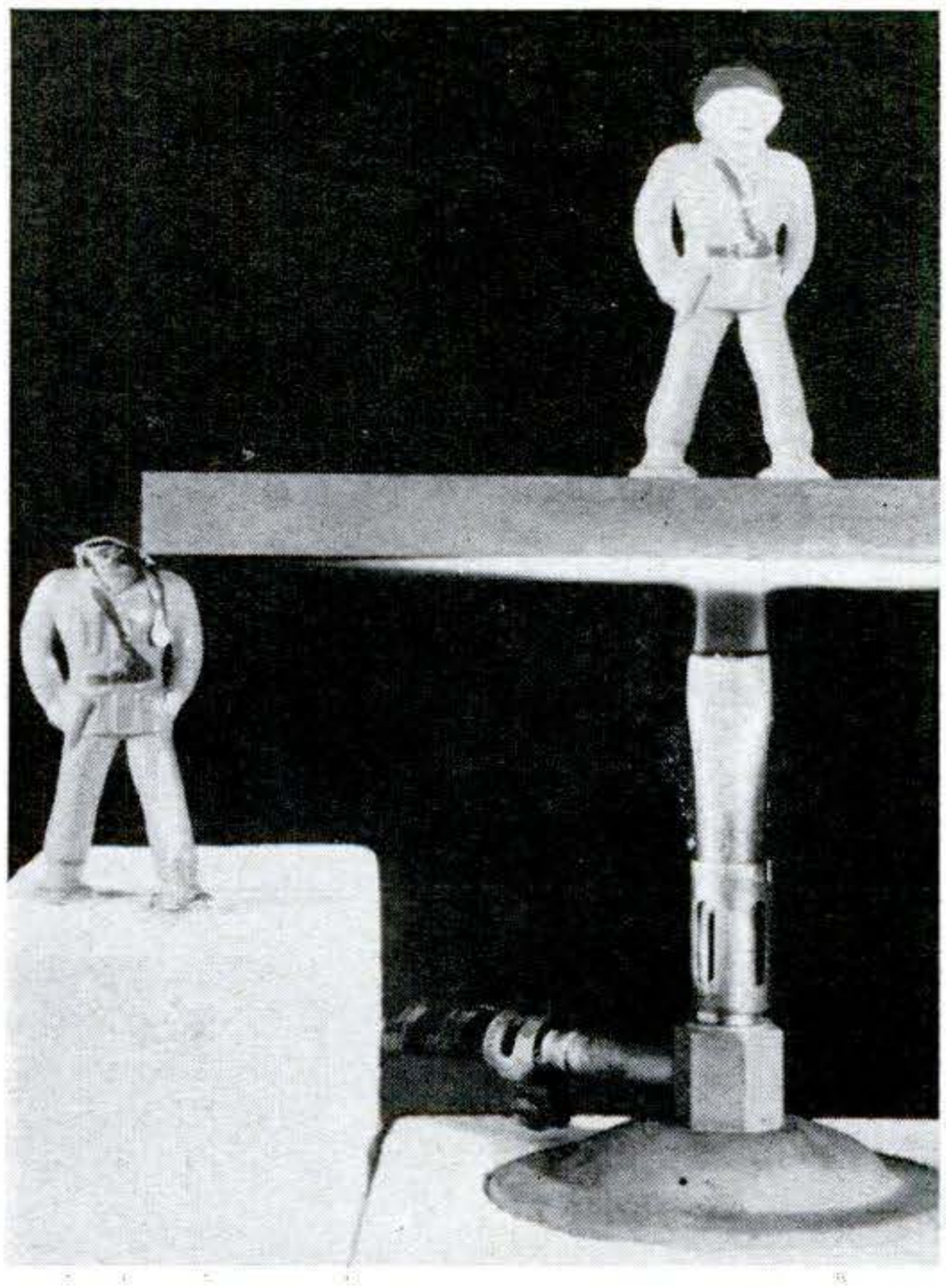
A 5½-MILE MOVING ROADWAY

That roller coaster (right) is really a belt conveyor that carries 1,000 tons of limestone an hour cross-country in Oklahoma. Changing direction four times, crossing highways and railroads, it runs from Ideal Cement's quarry to its mill.

Seven separate conveyors feed consecutively. A push-button starts the one next to the mill and —as its tail pulley reaches half speed— a relay starts the one ahead. This in turn starts the next one.





HEAT BARRIER. Lead soldiers show how Pyrographite solves missile problems. Heat, flowing along the surface of Raytheon's high-heat insulator far better than through it, melts the head of one soldier, leaves the other unaffected.

Boxy trailer on road resembles cargo hauler.

Parked, the front drops, showing band shell.

BANDWAGON. This $10,000 trailer opens and becomes a bandstand for outdoor concerts, or, with the floor laid flat, a stage for plays. Overhead fluorescent lights will hook into power lines of parks in New York's Westchester County.

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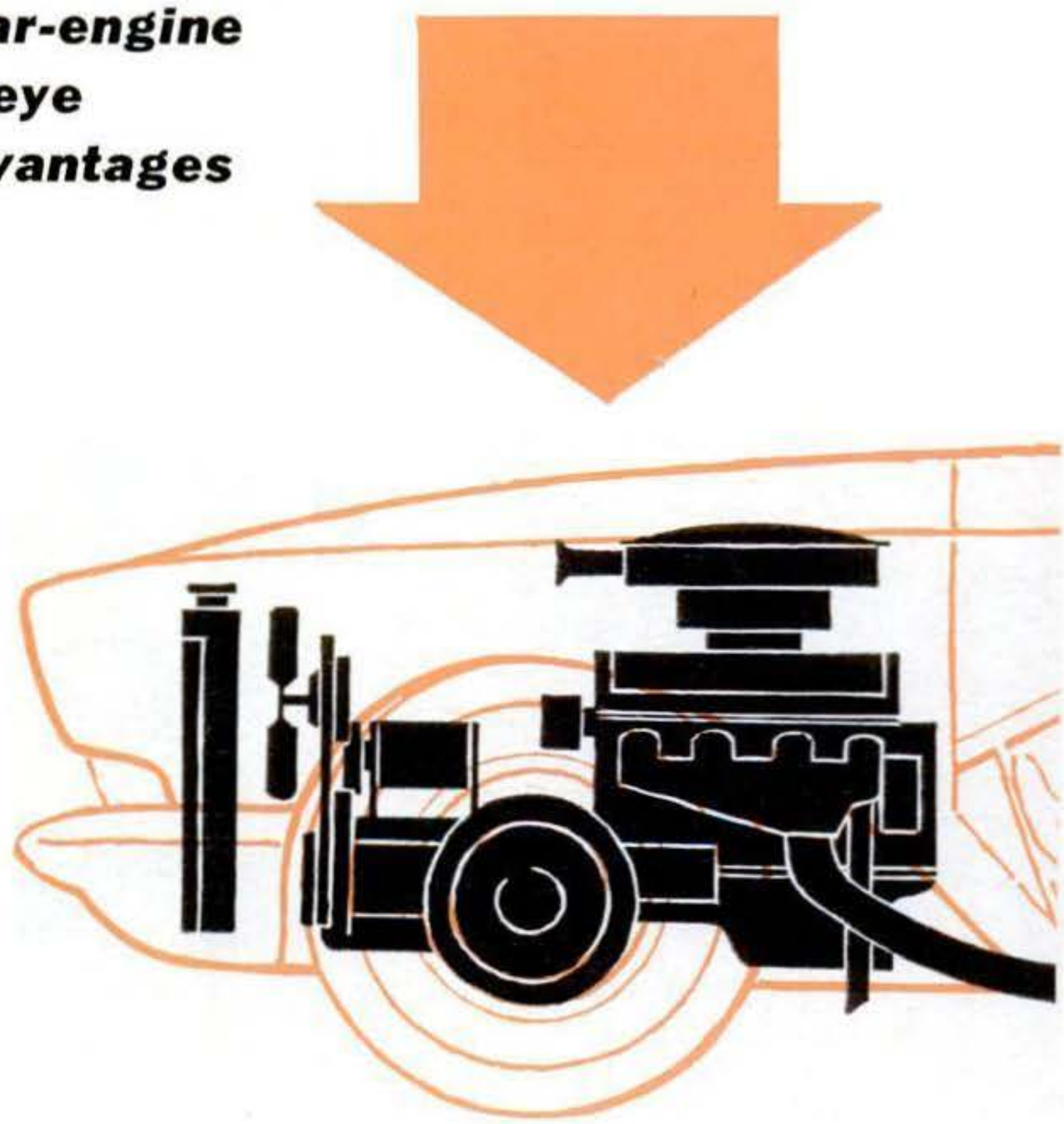
Are U.S. Front-Drive Cars Coming?

Now that auto buyers have taken rear-engine cars in stride, Detroit is casting an eye at another maverick with unique advantages

By Ken Fermoyle



FIRST, rear engines. Next, front-engine, front-wheel drive? This is a real possibility—for Detroit is definitely showing signs of interest.

Ford, in particular, is studying front drive. The company overhauled a Cord more than a year ago, and has used it for extensive tests. Saabs and other front-wheel-drive imports, moreover, are scurrying around Ford test tracks. Both American and British Fords have been converted to front drive for engineering studies. Such activity, while not unusual in terms of Detroit research programs, does indicate at least the possibility of a front-wheel-drive Ford in the future.

Front drive has many of the advantages over the conventional front-engine, rear-drive arrangement that moving the engine to the rear does.

It eliminates the space-stealing drive shaft, a headache for passengers sitting in the center, as well as for chassis engineers and body designers. Floors can be perfectly flat. Height can be reduced with no sacrifice in interior height. Weight can be cut and center of gravity lowered.

Front-wheel drive has additional advantages over rear-engine designs:

- More luggage space. There's more room between the rear wheels than the front ones, which need clearance to turn.

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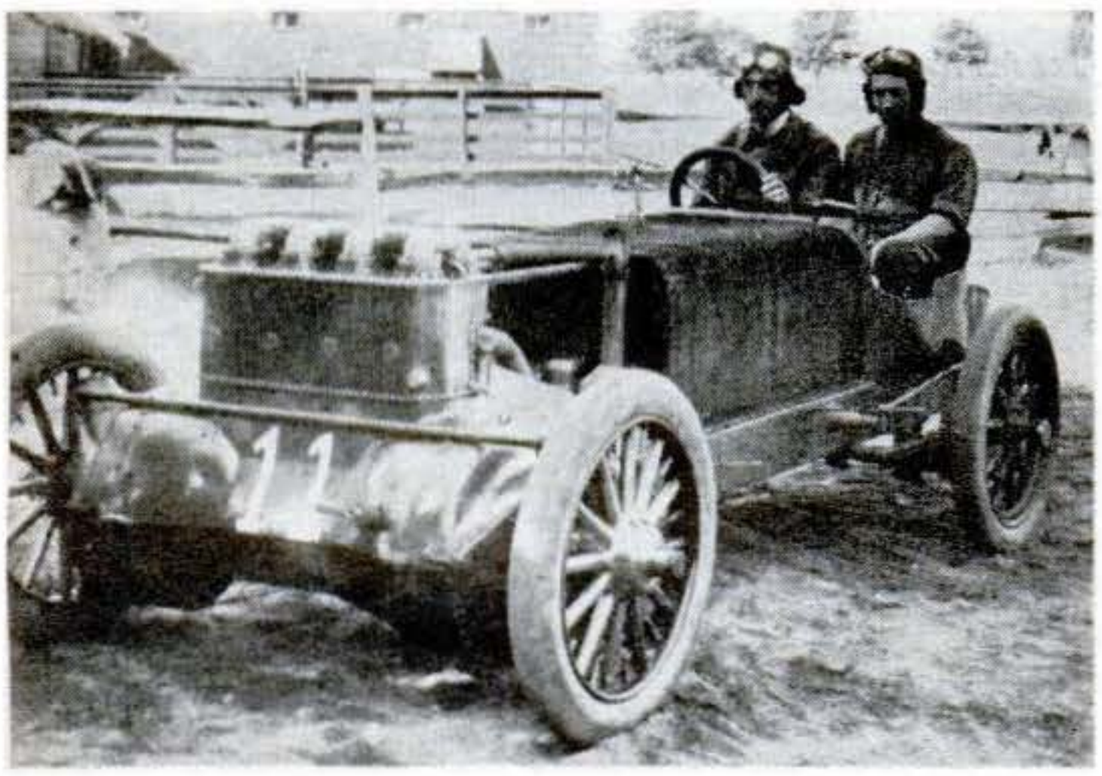

Christie was an early U.S. F-W-D production car, Cord the latest

1904 CHRISTIE RACER had a bulky, four-cylinder engine mounted transversely over mammoth front-drive machinery. Hard to handle because of all this weight up front, it still set record of 102.8 m.p.h.

1936 CORD CONVERTIBLE and two sedans put the company back in business after a four-year gap. But it folded in 1937 for good. The first Cord, model L-29, was made from 1929 through 1932.

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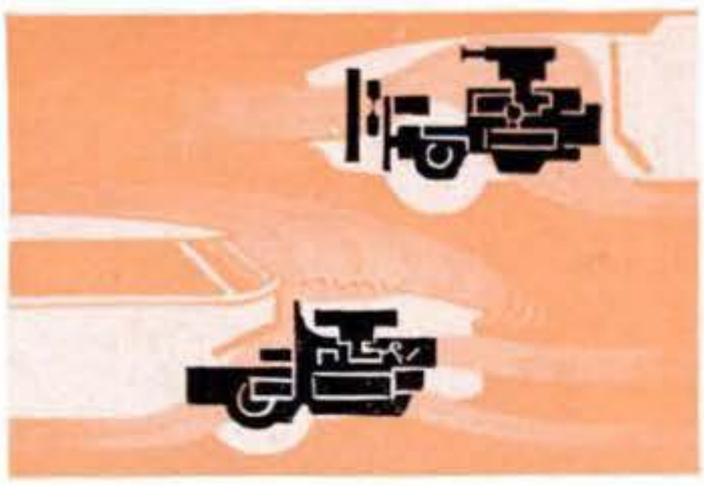
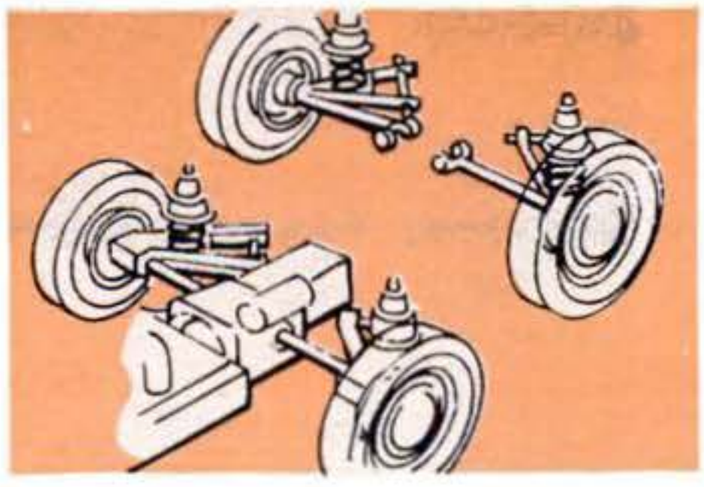
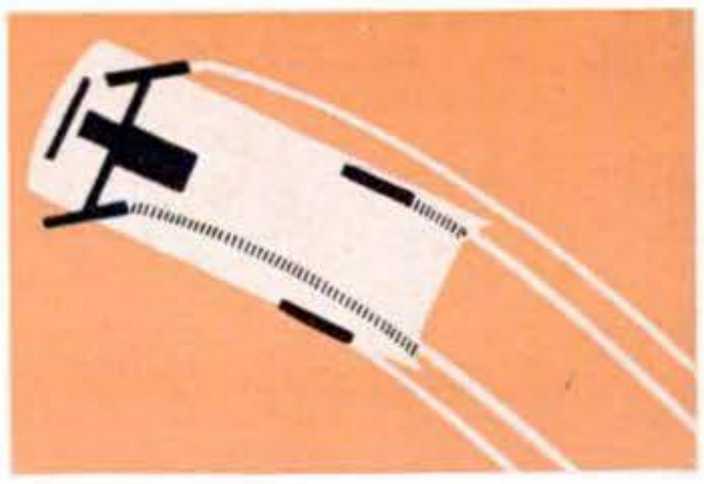
What's good about front-wheel drive



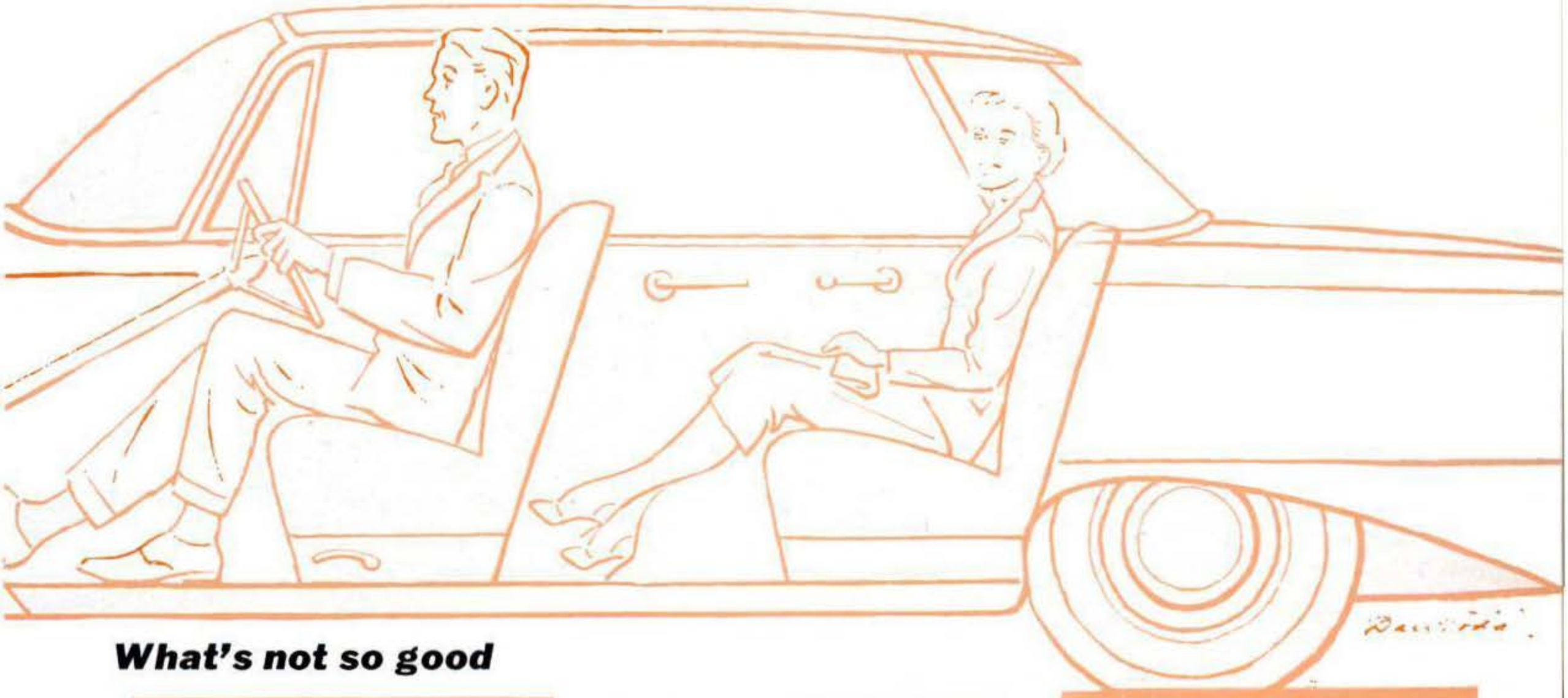
Cooling an engine up front takes simple grille instead of ducts.



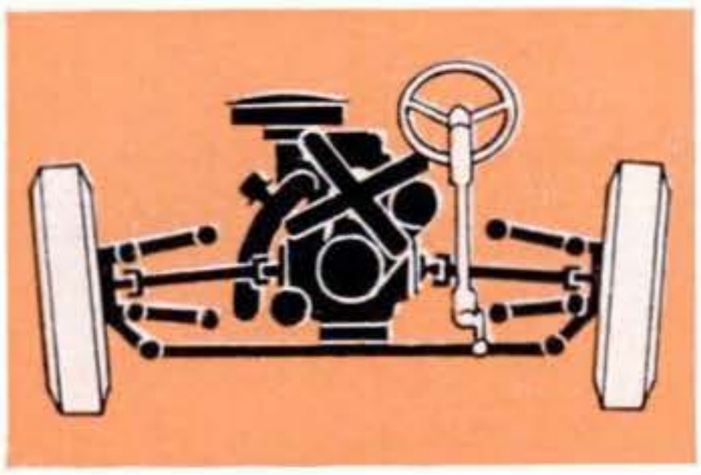
Independent suspension of each rear wheel is cheap and easy.



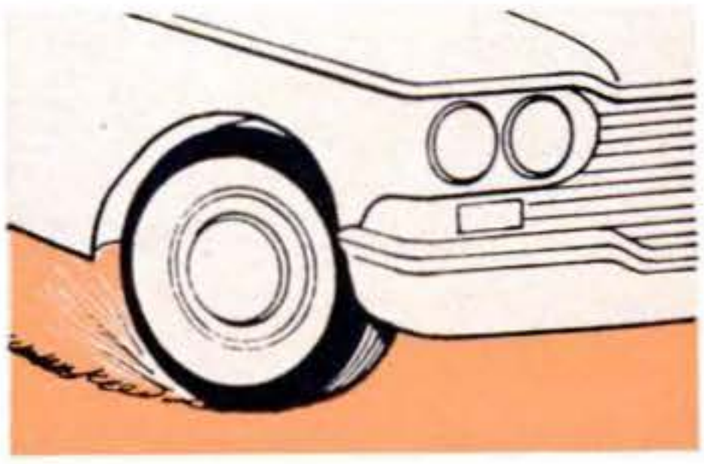
Directional stability is better, according to some experts.



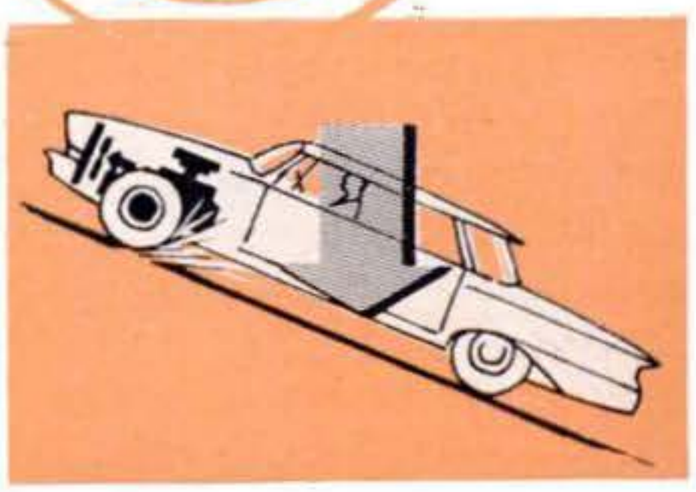
What's not so good



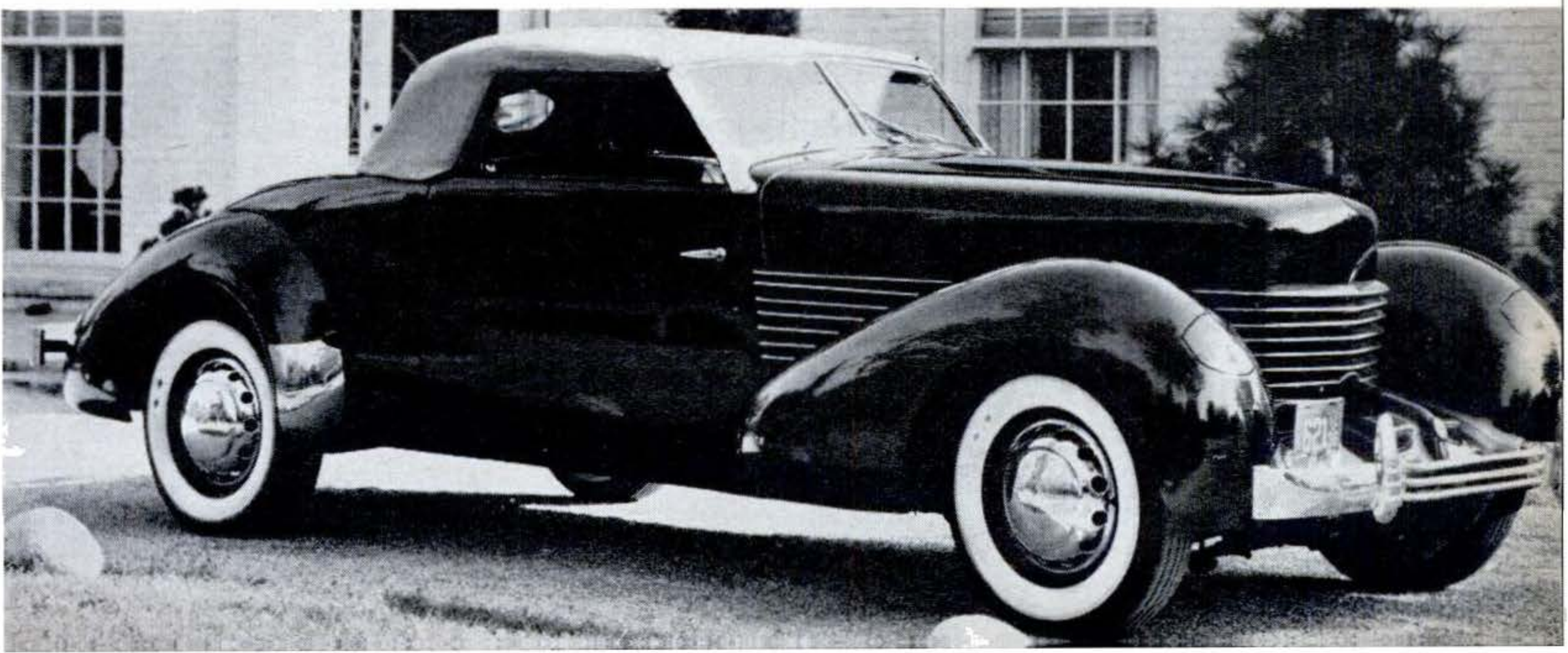
Steering is harder because of extra weight on the front end.



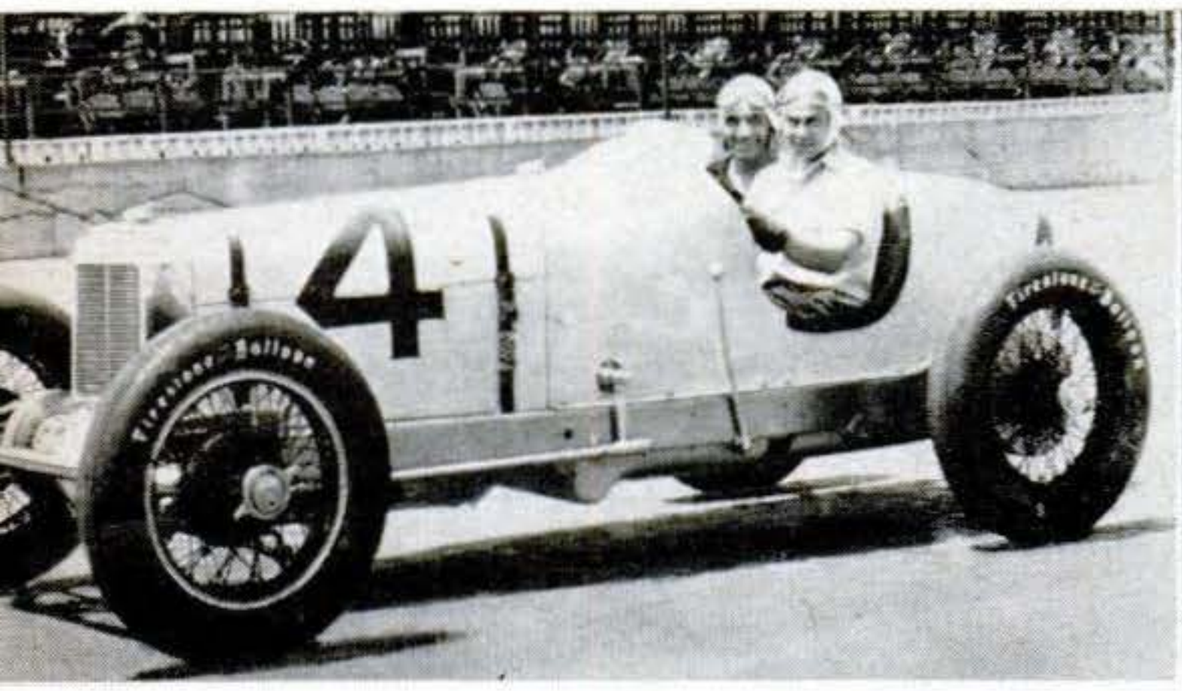
Front tires, handling driving power and steering, wear faster.



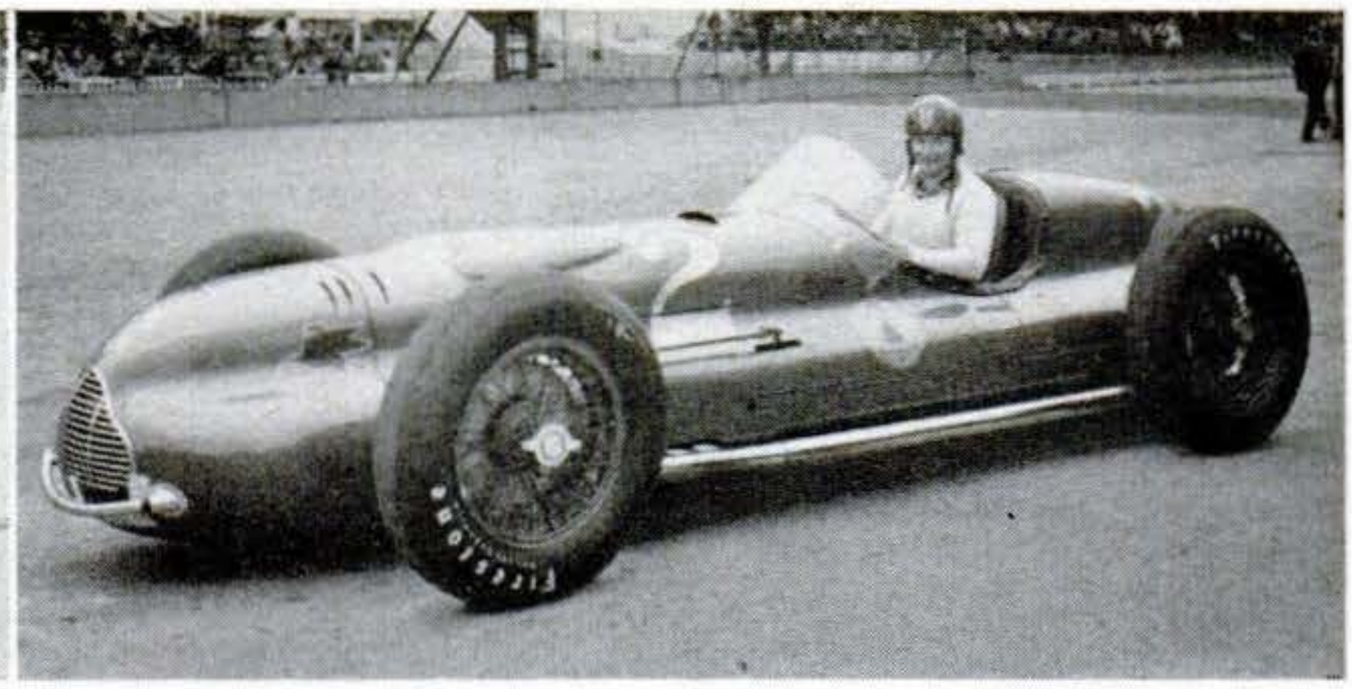
Hill traction suffers when the center of gravity shifts to rear.



In U.S., front-wheel drive has appeared mostly on racing cars



MILLER-HARTZ SPECIAL, piloted by Billy Arnold, won 1930 Indianapolis at 100.4 m.p.h.



NOVI GOVERNOR SPECIAL set Indy lap record of 134.4 m.p.h. in 1946. Ralph Hepburn drove.

- Simpler rear suspension. Engineers don't have to worry about driving forces. Springing rear wheels independently becomes cheap and easy.
- Easier engine cooling. A conventional grille opening will feed lots of air to a front engine.
- More familiar handling. Front-drive cars tend to understeer; rear-engine cars to oversteer. The average driver is safer in an understeering car, say most experts.
- Better adaptability to various body styles. Front drive is ideal for station wagons and light trucks.

Front-wheel drive involves problems, too. Here are the most important:

- Harder steering. Added engine weight on the front wheels makes them tougher to turn.
- Greater tire wear. Since front tires handle both steering and driving forces, they're apt to wear faster.
- Costlier parts. It takes constant-velocity universal joints to make front-wheel drive work right—and they cost more than simple U joints.
- Poorer traction on steep hills. Weight shifts toward the rear, lessening the load on the front wheels and reducing their "bite."
- Front brakes work harder. Nose heaviness and weight transfer forward in stopping make the front brakes carry most of the braking load.

Front-wheel-drive L'Universelle is GM's experimental vehicle for many uses

WITH NO DRIVE SHAFT between front and back, the floor in the spacious L'Universelle is flat and low. The 180-hp. V-8 engine sits astern of the driven front wheels. Air drawn through a grille in the roof flows down to the radiator through a duct. Shown here is the panel-truck version of the General Motors all-purpose vehicle.

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But many European passenger cars have it now

FRENCH CITROEN includes front-wheel drive among its many unorthodox "advanced" features.

SWEDISH SAAB couples a two-cycle engine to front drive, has won many road-car rallies.

These difficulties don't look as formidable as they did a few years ago. U. S. car buyers are evidently ready, even eager, for smaller cars—and these are especially suited to front drive. Even in standard-size models, the problems can be solved.

Vanishing headaches. Modern steering gears, especially power-assist units, can overcome hard steering. Light, compact engines and transmissions are being built. More are on the drawing boards. These would take care of space and weight problems.

Constant-velocity U joints, not needed in conventional drive trains (where U joints don't have to cope with such severe angles and where pairs of them can be arranged so their changing velocities cancel each other out) are no longer a mystery. They've been used widely in civilian and military vehicles—four-wheel-drive jeeps and trucks, for example. Even though more costly than simple U joints, they would become reasonable enough in mass production.

The pioneers. Front-wheel drive has not, of course, been unknown on American cars. There was the front-drive Christie which appeared in 1904 and set a speed record of 102.8 m.p.h. as early as 1908. Then came the appropriately named Frontmobile and Front Drive. The Ruxton bloomed briefly in 1928.

The name that means front-wheel drive to most Americans, however, is Cord. Its L-29, introduced in 1929, was first. It suffered from poor weight distribution. The differential was even with the front wheels. The transmission and a long straight-eight engine were mounted in line behind it. This made for an impressively long hood, but didn't place enough weight on the driving wheels to give them adequate traction.

This was improved in the coffin-nosed Cords of 1936 and 1937. The differential was still centered between the front wheels, but ahead of it was the transmission. Behind the differential was a short V-8 engine. These 810 and supercharged 812 Cords had troubles, but are still held in high regard by auto enthusiasts.

Gordon Buehrig, the man who styled them (and who now works for Ford), feels the big reason they weren't more successful was that "we just didn't have enough time and money to develop them fully before they went on sale. As a result, problems cropped up in early production."

Inadequate radiators caused overheating. The preselector gearboxes with vacuum shifting, used to simplify linkage problems to the forward-mounted transmission, jumped out of gear. There were some difficulties in lubricating and sealing the U joints.

"We licked these flaws and others that turned up, and later production models were good cars. But a lot of harm had been done," says Buehrig.

On the track. Front-drive race cars have had a successful history on U. S. tracks. A front-wheel-drive Miller Special, called the Junior 8, was the first of the breed to run in the Indianapolis 500. It appeared in 1925—and placed second.

Billy Arnold won the 1930 500-miler in a Miller-Hartz Special, which had

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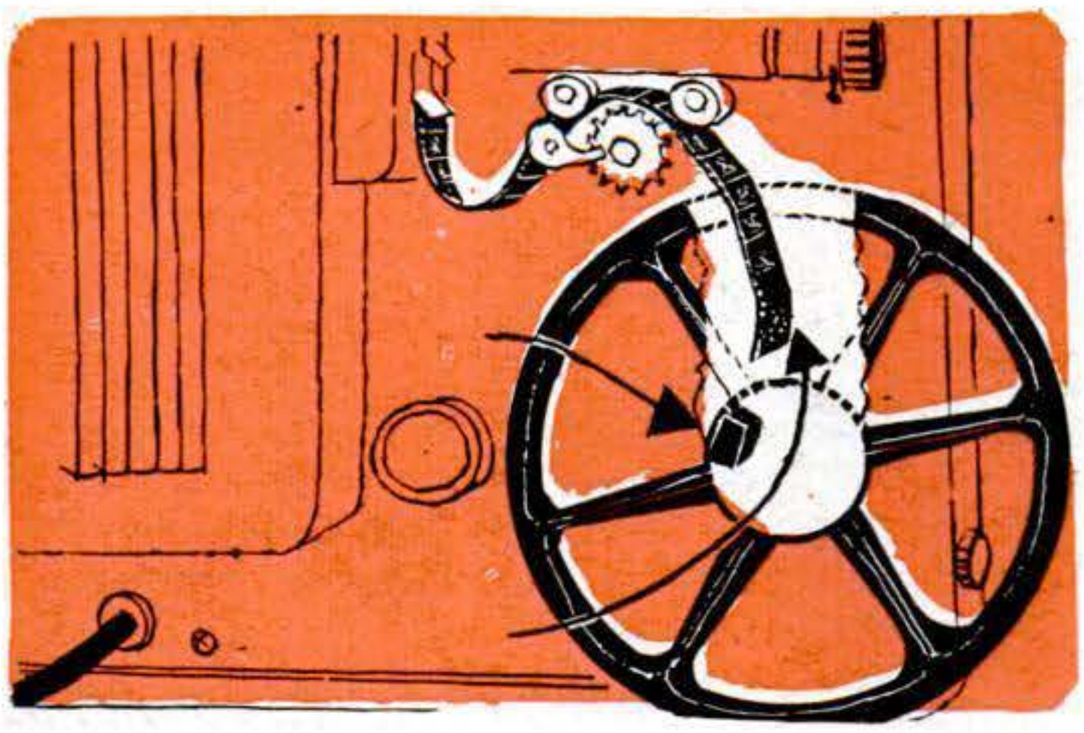
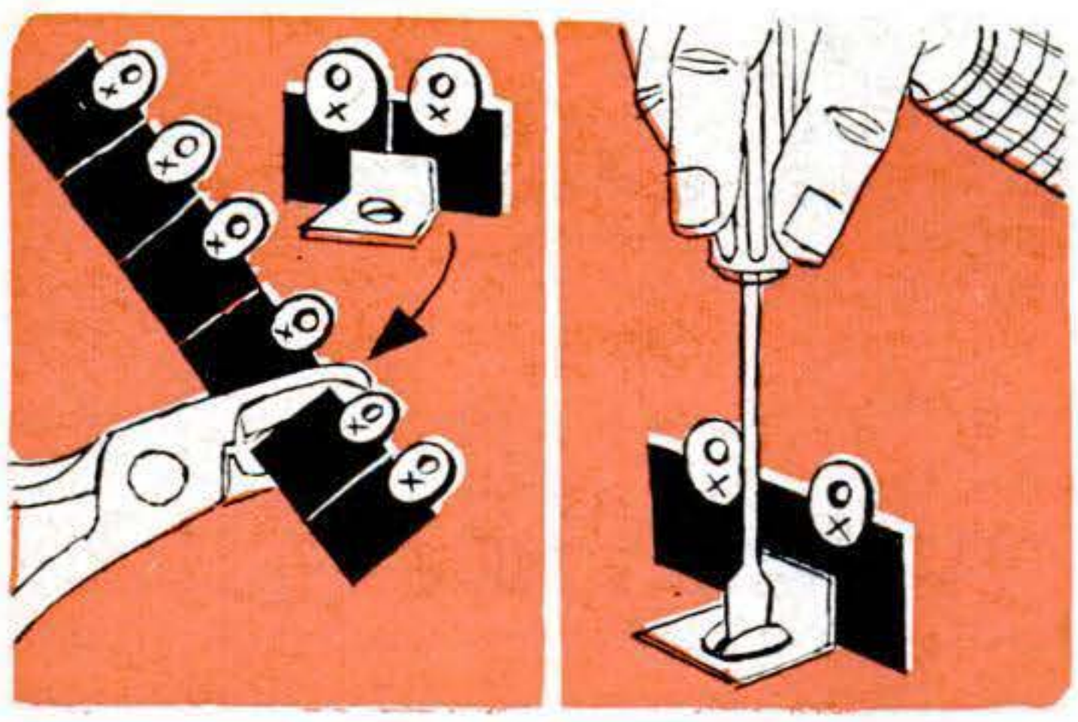
"I'd like to see them make..."



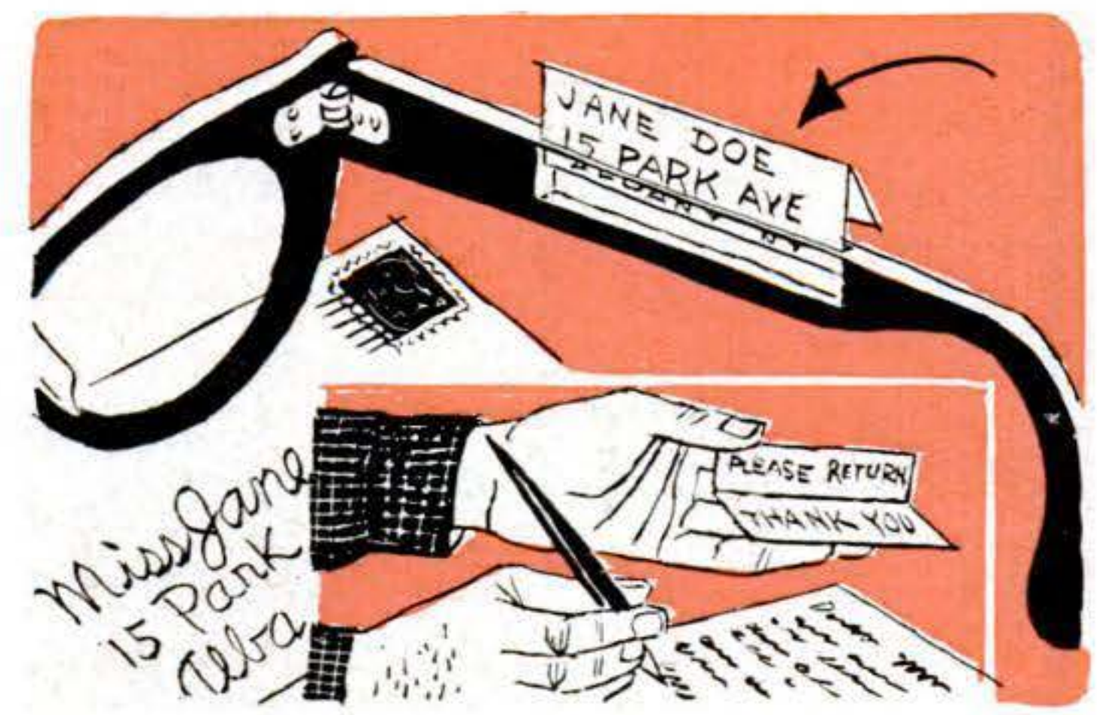
A MAGNET ON THE HUB of movie-film reels. Then with some iron filings cemented to the end of the leader film, it would be easy to thread.—*H. L. Woodward, Sioux City, Iowa.*

A PULL-DOWN PARTITION in station wagons for more warmth up front. How about a transparent recessed roof panel riding on tracks like a garage door?—*J. J. Vernimmen, Grand Rapids.*



RADIO TIE POINTS on long strips that could be cut apart. You'd snip off the number of points needed, and then clip them to the mounting lugs.—*D. P. Schneider, Waterbury, Conn.*

ABRASIVE GLOVES with a coating of sand on the palms and the front of the fingers. They'd be fine for light sanding, particularly on small objects.—*Kay Gordin, Derby, Kan.*



EYEGLASSES WITH A POCKET in one sidepiece to hold an identification plate with owner's name and address. Then lost glasses might be returned.—*R. F. Swenson, Worcester, Mass.*

Everyone has his own pet idea of a gadget that he would like to see in general use. The five ideas illustrated above were suggested by POPULAR SCIENCE readers. What's *yours?* We will pay $5 for each one published. Please use Government postcards only. Write name and address clearly. Contributions cannot be acknowledged or returned.

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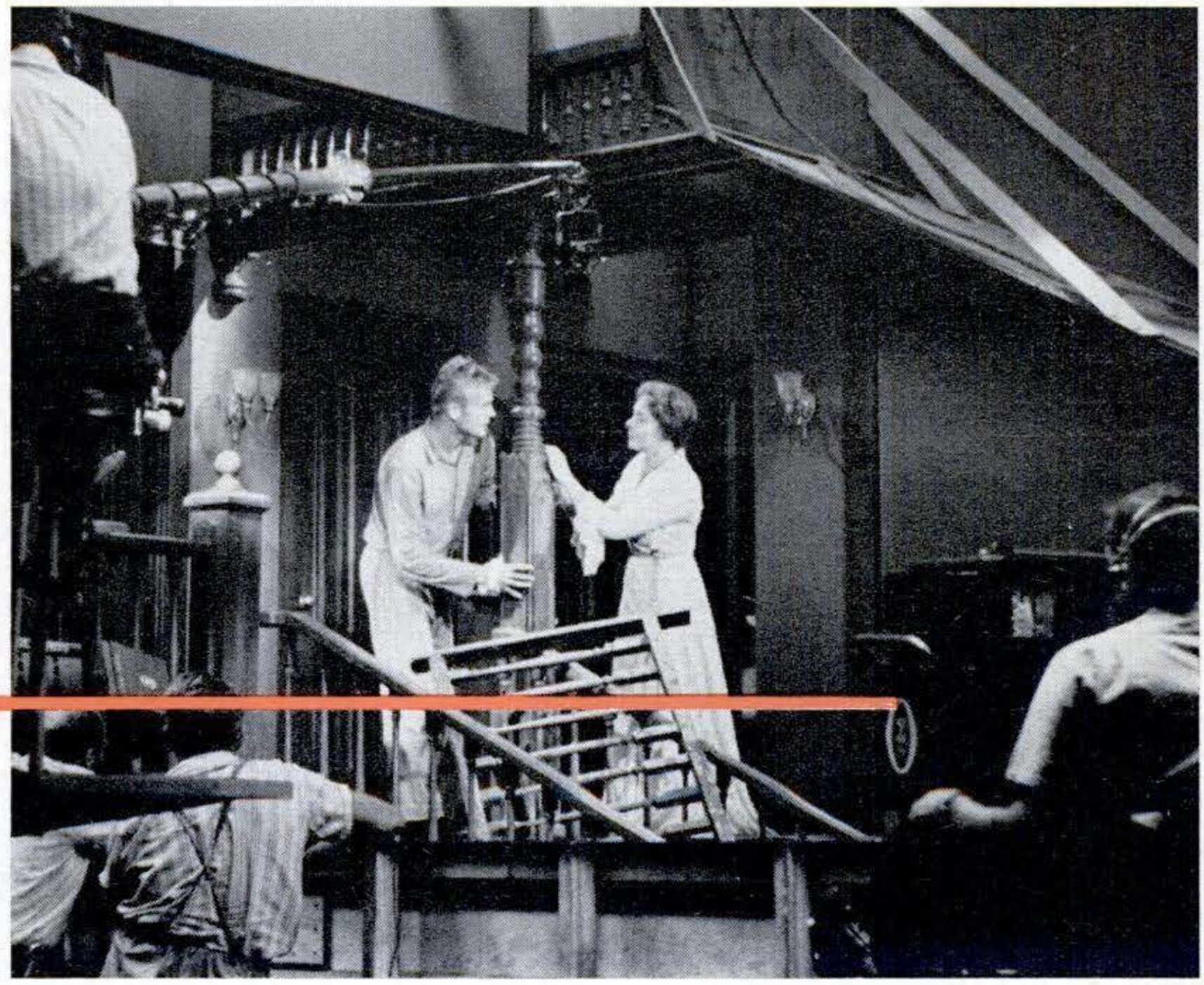
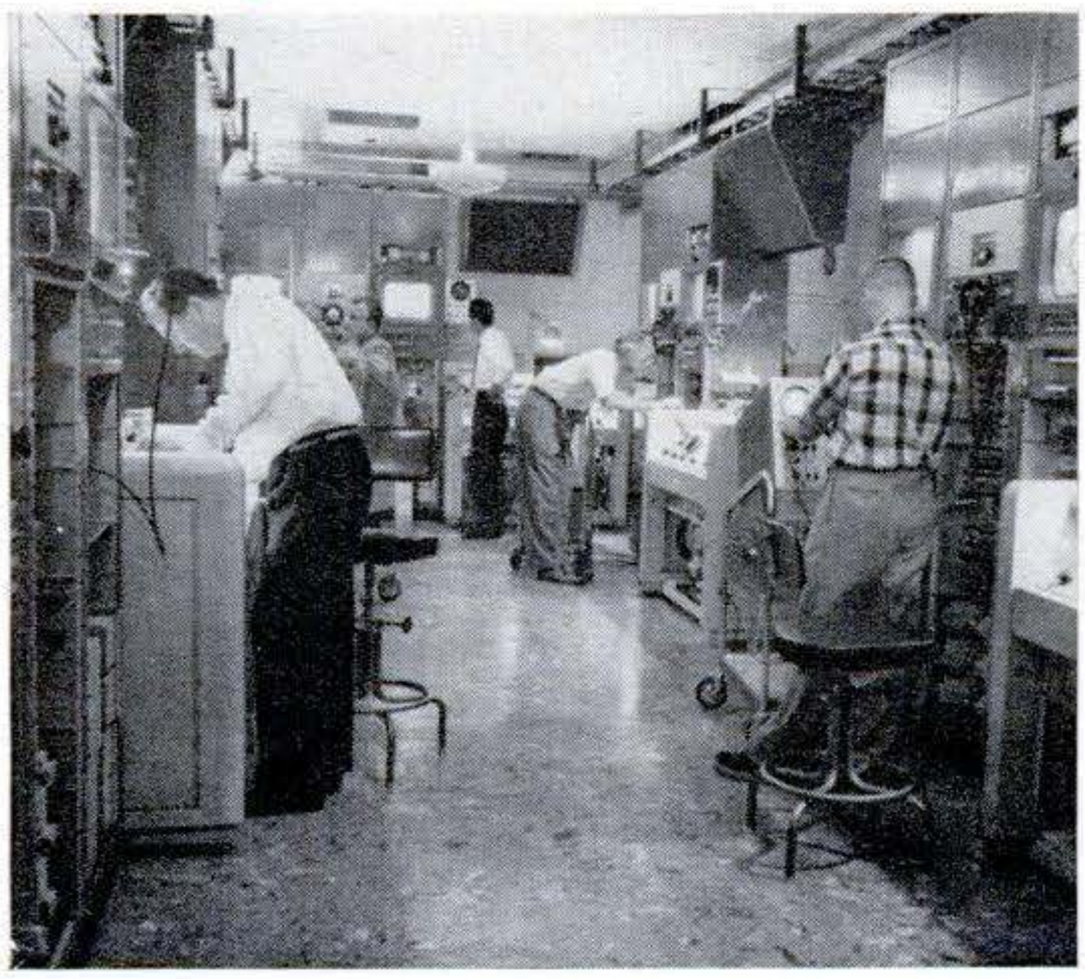
A modern miracle of electronics lets performers put on a show when they want to, lets you see it when you want to

TV Goes to Tape

It looks live but it's not

Recording a drama on video tape involves no change in mike, cameras, or lights from a live show. Here Tab Hunter and Jo Van Fleet tape a tense scene of "Disaster Area" for telecasting on GE Theater months later.





IT'S PRESERVED ON PLASTIC HERE, in equipment room of CBS Television City, half a block from the performing studio. Tape can be played back immediately, to let cast see how they've done.

THIS year much of the "live" TV you see is about as live as a six-months-frozen mackerel. The shows come off a chocolate ribbon of plastic—video tape—that was recorded anywhere from a few seconds to a year before you see them.

Most of the specials—big-budget drama or song-and-dance—are performed in person only for the tape machines. Increasingly, half-hour filmed shows are switching to tape. And if you live west of the Eastern Time Zone, you get taped playbacks of programs that Easterners see live.

It is a jaw-dropping wonder of modern science that all the sights and sounds of life can be captured on a frail-looking ribbon and then re-created immediately, without processing. The re-creation is

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How They Record Television on Tape

In storing a television program on magnetic tape, an enormous amount of electronic information must be crowded into a small space. There may be no more than 30,000 audio (sound) signals per second to record, but the video (picture) signals are likely to total 3,000,000 per second!

To capture this vast swarm of electrical impulses, you need a great many particles of magnetic oxide. This means that the particles have to go past the video recording head very, very fast. The tape itself moves 15 inches per second, not nearly fast enough. So the video recording heads move, too, crossways to the two-inch-wide tape. The combined effect of recording-head movement and tape travel is equivalent to a tape speed of 1,500 inches per second.

There are four video heads mounted 90 degrees apart on a small wheel that spins at 14,400 r.p.m. The heads, only 10 mils wide, protrude from the wheel edge like circular-saw teeth. They record in sequence, each taking its turn when it is adjacent to the tape. This leaves video tracks across the tape 10 mils wide, with a five-mil space between each track. One track records about 16 lines of a 525-line TV picture.

The audio signals, not nearly so numerous, are recorded along the length of the tape, as on a home tape recorder, but in a ⅛-inch band at the top. A tiny extra sound track—the cue track—along the bottom edge of the tape records timing signals, instructions to the operator, and pulses to guide an editor in splicing the tape.

Going through the Ampex machine shown here, the tape first rounds a full-width erase head. That's to make sure it is completely demagnetized of any previous signals and is ready for a fresh recording.

The tape then runs through the video-head assembly, past erase and recording heads for both audio (top) and cue (bottom) tracks, through a capstan assembly that keeps pulling it forward at a constant speed, and around an automatic timer. The tape is forced against the video heads with a pressure of 1,000 lb. per square inch. (This creates great friction and heat). Vac-

often (but not always) so good you can't tell it from the real thing.

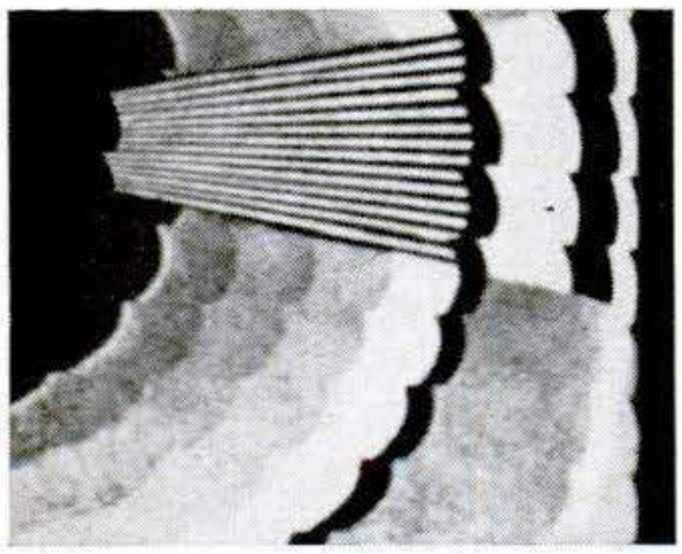
The big advantage of recording television electronically and broadcasting it later goes to the TV industry. The reasons are complex, but they all add up to saving money.

Still, you gain, too, because you see better shows. Scenes can be reshot time and again until they are just right. Muffed lines and sour notes can be edited out. Star performers, whose winter evenings might be committed to the legitimate theater, can usually be enlisted for a mid-day taping session.

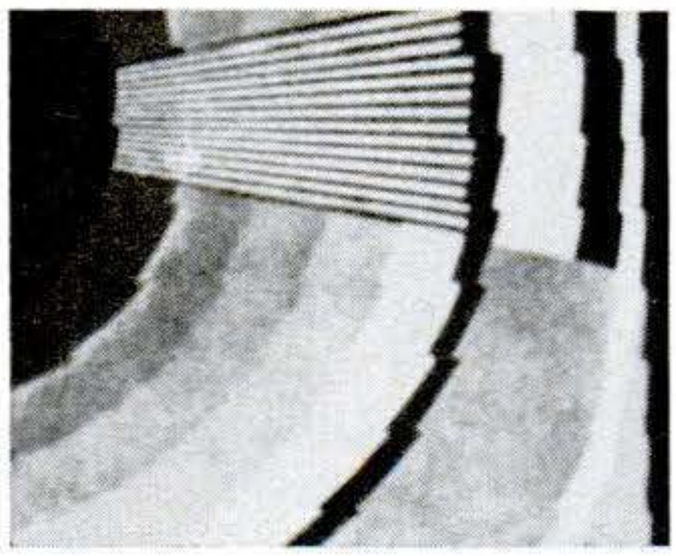
Tape also brings you the shows at a convenient time—Dinah Shore's happy smile appears at nine p.m., whether you live in Seattle, Albuquerque, Kansas City, or Pittsburgh. (To manage that from Hollywood, where nine o'clock arrives last, Miss Shore actually starts singing at six, Pacific Time, and the East sees the show live.)

How it's done. Last summer Tab Hunter and Jo Van Fleet made a tape of "Disaster Area." To a visitor on the set, it looked as though the play were being telecast live. Standard TV cameras and microphones fed their signals to the con-

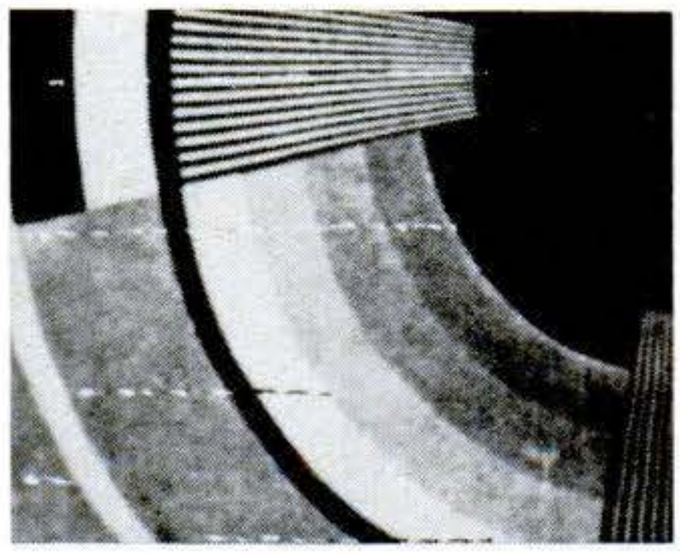
Is it live or tape? Defects tip you off to a canned show



SCALLOPING: If tape isn't lined up in the recording machine, straight vertical lines acquire sharply wavy edges.



VENETIAN BLIND: Sometimes one of the four reproducing heads presses the tape too hard—vertical edges zig-zag.



BRUSH NOISE: Streaks—similar to ignition interference—come from poor contact in connection to rotating heads.

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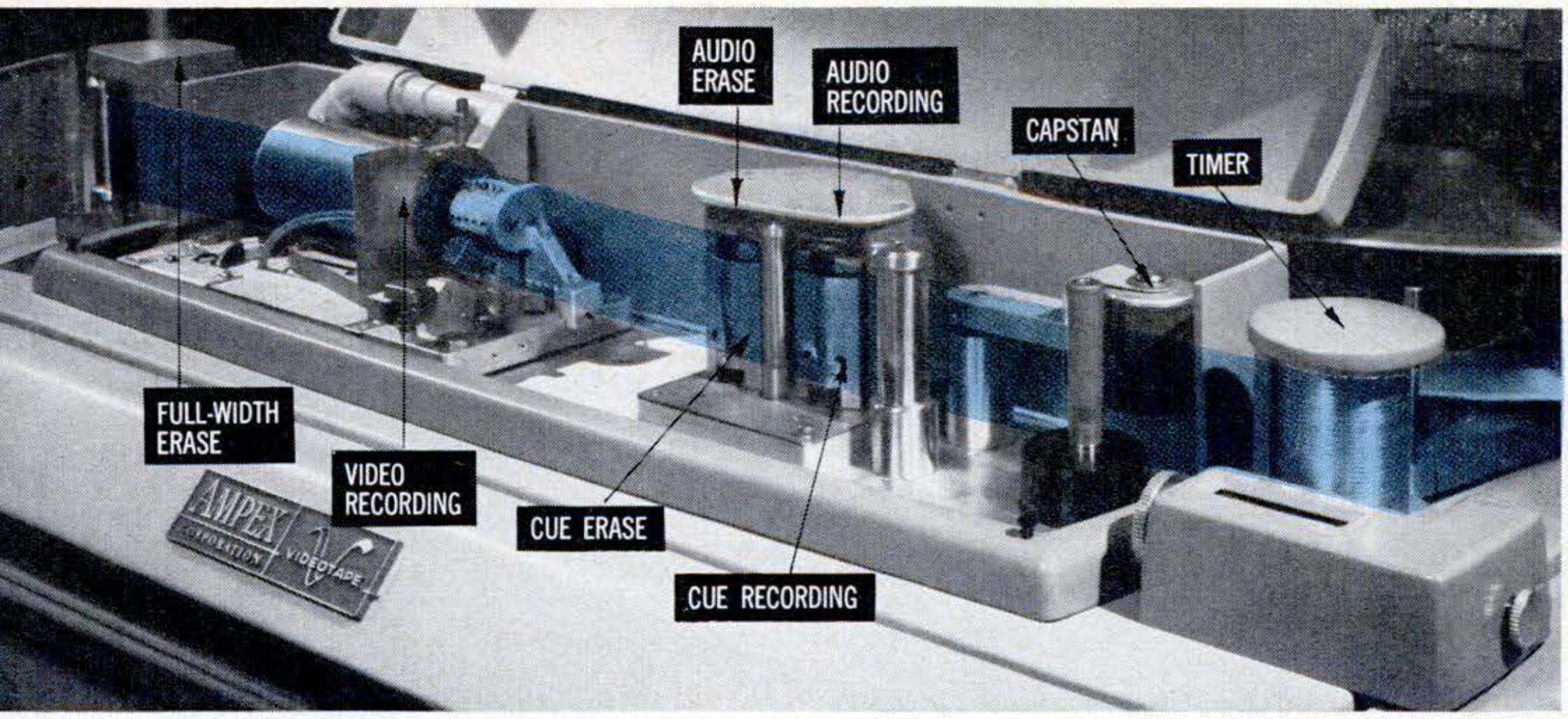

uum holds the tape firmly in place in a concave guide.

When a program has been recorded and is played back for telecasting, the recording heads pick up electrical signals from the tape instead of leaving magnetic patterns on it. These signals are fed from the recorder to a TV transmitter, and you see them on your home set just as if they were coming straight from the camera.

trol room. But then the signals went, not to a transmitting antenna, but to a room on the floor below.

Here, a man with headphones sat at a steel cabinet the size of an office desk. On top lay two chunky metal reels loaded with video tape, two inches wide and almost as thin as carbon paper.

The tape rolled 15 inches per second, quietly recording a tense living-room scene. The operator could see the action only on the monitor screen above him.

After three or four minutes, the monitor went blank and an unseen voice said, "Let's see that scene, Jim."

Jim sent the tape whirring backward for an instant. Then he leaned toward a mike. "Okay. Here goes."

Onto the monitor screen flashed the images of the actors on their sofa, as bright and clear as before. When the television audience saw the play months later (as part of the General Electric Theater series), they saw it the same way, off the tape. That tape could be repeated 100 times or more without noticeable loss of clarity. Or the same tape could be used to record 100 different shows, and erased after each one. Some tapes have already weathered as many as 200 replays.

Video tape, made by Minnesota Mining and Manufacturing Co., is glossy on one side, dull on the other. The glossy side is Mylar plastic, .001 inch thick.

The dull side is where the recording is done. It looks just the same after it has stored a television program as it did before. It is an ultra-thin pigment of iron oxide. It has to be fantastically even and smooth. An imperfection as small as 30 millionths of an inch can cause it to miss

[Continued on page 236]

TV TAPE FOR HOMES: This is RCA's experimental playback machine, designed to show prerecorded tape on your living-room TV set—the equivalent, for sight, of a record player.

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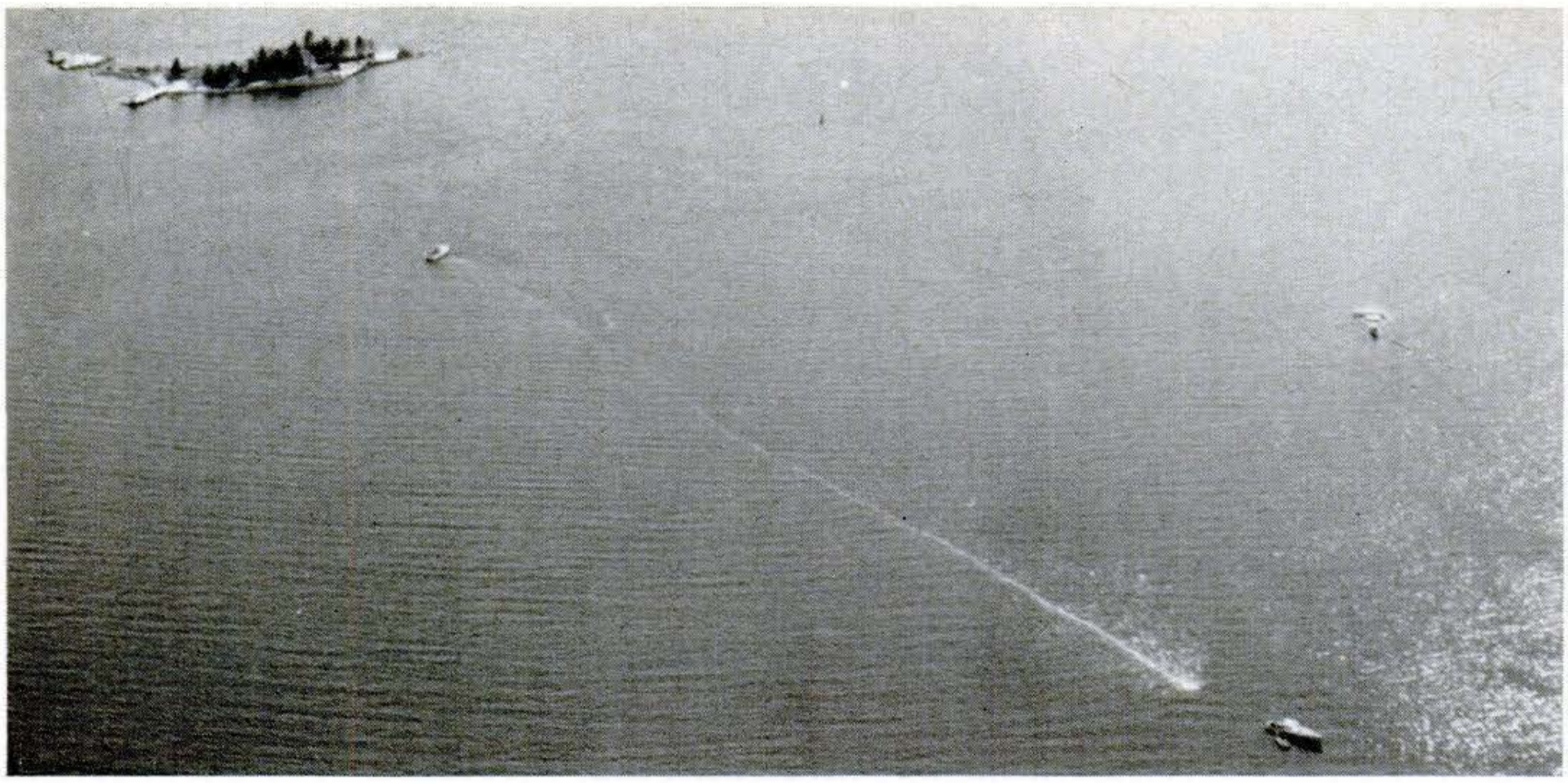

Air-bubble curtain above diverts fish toward two fishing boats off the coast of Maine.

CATCHING FISH WITH AIR BUBBLES

Maine fishermen now guide their prey into nets by means of a curtain of bubbles. They lay a perforated hose in water too deep for nets, pump compressed air through it, and wait at either end with seines spread. Small fish won't go through disturbed water, so the schools parallel the trail of bubbles, seeking calmer passage. The method was developed by the U. S. Bureau of Commercial Fisheries.

FLYING FIREMEN. Wind blasts from the rotors of a hovering helicopter drive back flames here to let a ground crew get in close to fight a fuselage fire. The technique was demonstrated at Randolph Air Force Base, Tex.

FOR THE HANDYMAN. Wilmer L. Wilson Jr., a farmer near Fort Dix, N. J., puts up and takes down storm windows the easy way. He has his wife pilot his tractor lift and boost him to the second-story windows of his farm house.

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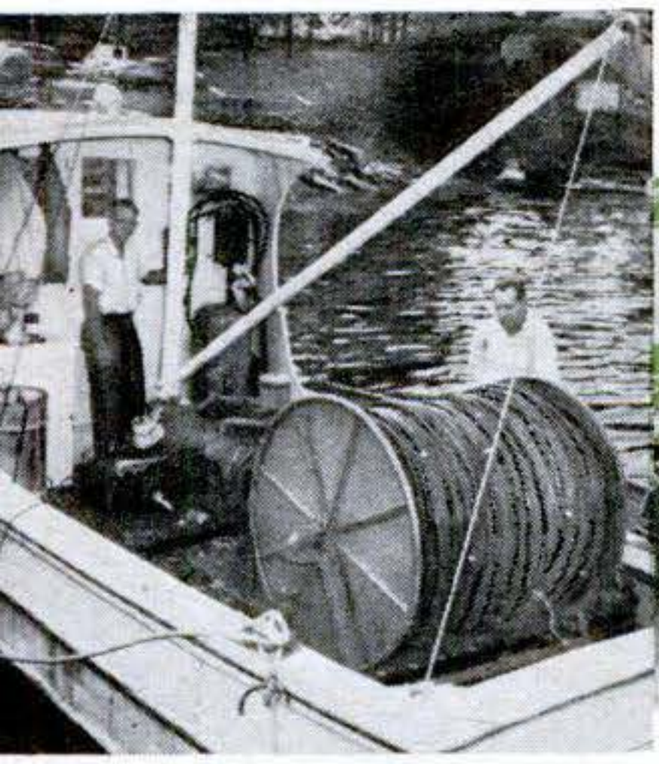


Perforated hose is unreeled from boat.

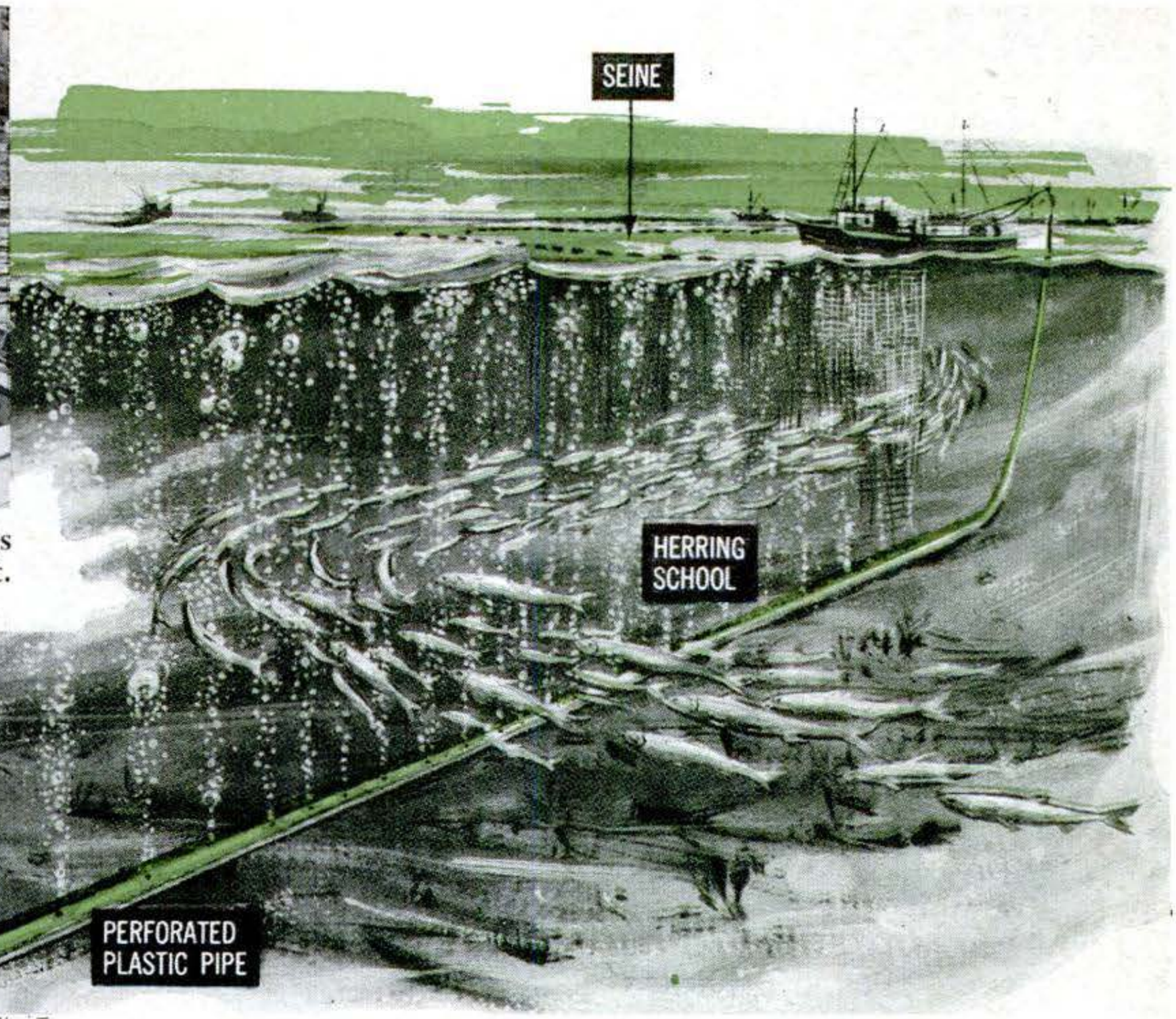
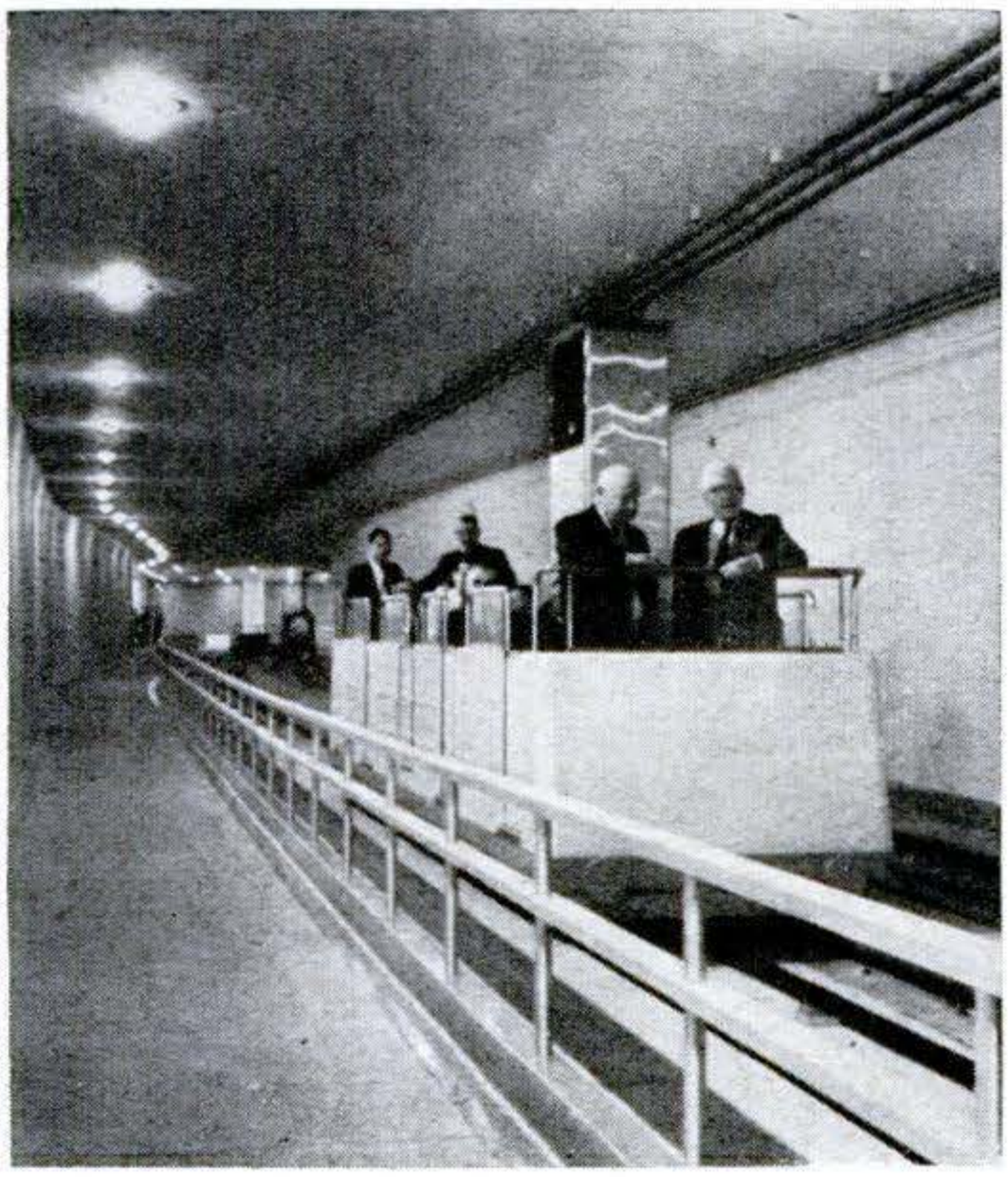


Diagram shows how air bubbles form a barrier, to send herring into fishermen's nets.



SENATE SUBWAY. Here is a really exclusive railroad. It runs in a two-block tunnel opened recently in Washington. The electric car is used for carrying U. S. Senators between the Capitol and their new Senate Office Building.

HINDSIGHT. The stinging tail of the Air Force's new B-52G mounts a TV camera over its cluster of four 50-caliber tail guns. The gunner, up front in the eight-jet Boeing, sees his target on a television screen, fires by remote control.

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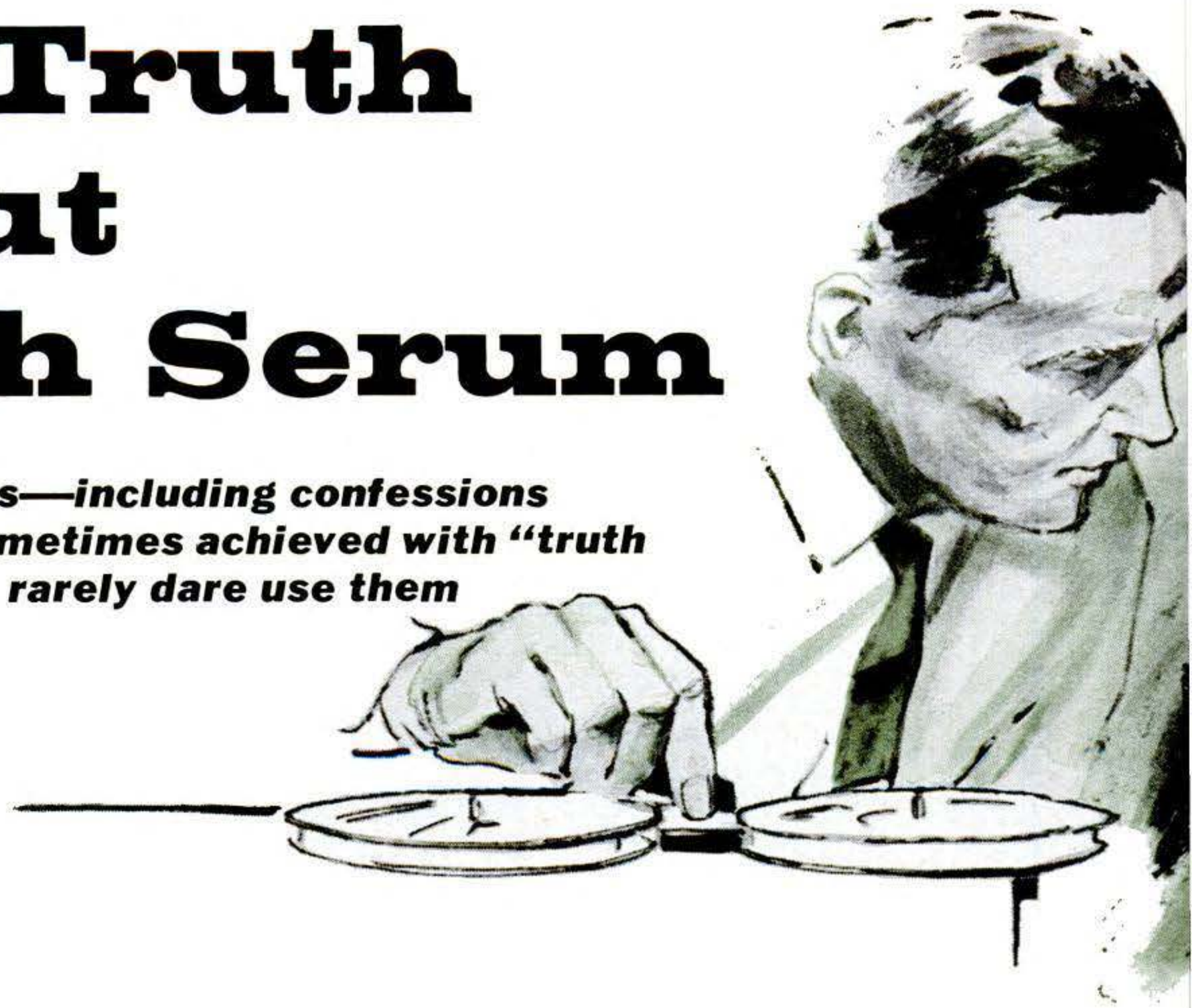
The Truth About Truth Serum



Spectacular results—including confessions of murder—are sometimes achieved with "truth drugs." But police rarely dare use them

By Wesley S. Griswold

THOUGH there is literally no such thing as a truth serum, it keeps popping up in print.

"The Bergen County (N. J.) prosecutor's office administered 'truth serum' today to the 22-year-old son of a widow who was found slain . . ."

"A self-styled amnesia victim from Georgia, who was identified last night after an injection of 'truth serum,' was booked in San Diego today on suspicion of murder . . ."

These are fragments from recent news stories. Reporters invented the name "truth serum" some 37 years ago, and have been using it ever since. By now, it is firmly embedded in our language. Doctors and psychiatrists deplore its inaccuracy, but you'll often catch them using it, too.

What is this mysterious potion?

It may be any one of several sedative drugs, mostly barbiturates, members of the sleeping-pill clan. It is not a serum. It does not guarantee the telling of truth.

When truth serum originally hit the headlines, back in 1922, it was a drug called scopolamine. Nowadays, it's usually sodium amytal or sodium pentothal. Small, carefully controlled doses injected in a vein bring a person to the threshold of unconsciousness. At that point he is very drowsy and his speech is thick. He is only vaguely aware of his surroundings. One has to speak loudly to make him hear. But he can open his eyes and sit up. His brain has lost control of his thoughts, however. His natural inhibitions are gone. He says things that guilt, fear, embarrassment, loss of memory, caution, or love or hate have kept him from saying

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when fully conscious with a tight rein on his thoughts. There are no harmful or unpleasant after-effects. A person only hazily remembers anything he said or was asked while under the drug's influence. His words are often tape-recorded and played back to him later.

The scientific name for this condition is "barbiturate narcosis."

What is it used for?

Barbiturate narcosis has been a great help in restoring the lost memories of amnesia victims. Psychiatrists find it valuable in helping some patients to understand, and thereby to recover from, psychological disturbances. During World War II and the Korean War, it was important in the treatment of battle fatigue and hysterical paralysis.

For police work, though, truth serum is generally shunned. Most big-city forces won't touch the stuff. But, as occasional news stories prove, others are not so leery of it.

How much truth does truth serum induce?

Quite a lot. But it is far from being infallible. Medical men and criminologists have been experimenting with so-called truth drugs for years. They have used at least 10 different ones. Some investigators have been remarkably successful. Most have not. A survey of all findings has shown that only about half of the time could statements made by persons under the influence of these drugs be proved to be true.

CONTINUED

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Often interrogators wound up with a collection of hopelessly conflicting answers. Frequently, what the subject related in his condition of altered consciousness, as it has been called, was pure fantasy.

Sometimes, though, a drug has wrought spectacular results. When William Heirens was arrested for attempted burglary in Chicago in 1946, he was hit on the head with a flowerpot while resisting arrest. Jailed, he lay for hours in an apparent coma. Meanwhile, detectives discovered that his fingerprints matched some found at the scenes of two unsolved murders.

Under drug's influence Heirens admitted killings, later signed a confession.

Police doctors suspected that Heirens was only pretending to be in a coma. To make sure, they gave him a shot of sodium pentothal. They got far more than they bargained for. Under the drug's quick influence, Heirens not only began to talk but told them that he had done the murders. He gave many details that were known to be true. He even revealed a third killing that the police hadn't yet found out about.

Although this drug-induced testimony could not be used in court, Heirens, after he was fully conscious, was told the incriminating statements he had made and readily confirmed them. He then signed a clear-headed confession that sent him to prison for life.

What is the legal status of truth serum?

In the courts, as distinct from medical use, these drugs are almost always outlaws. The Bill of Rights protects every American citizen from being forced to testify against himself. Courts have held this to mean that no one can be given an injection of a drug that will make him talk unguardedly to police unless he is first told that he runs the risk of self-incrimination. If he is willing to take the chance, he must then sign a statement to that effect.

In addition, his attorney and the opposing lawyer must agree to accept whatever he says under sedation as valid testimony. Finally, the presiding judge must be willing to admit the testimony.

Such unanimous agreement hardly ever happens. Most lawyers and judges feel that the results of questioning a person with the aid of truth serum are too uncertain to be trusted. Most police departments string along.

Has it ever determined a verdict?

Very rarely. In 1954, for the first time in the history of federal courts, a district judge in Washington accepted testimony obtained with sodium amytal.

The contesting parties were a soldier and a girl who had accused him of housebreaking and assault. The soldier stubbornly insisted that he was innocent. The girl clung to her story. Finally, the judge asked that both be given truth-serum interviews. The result was an eye opener. The girl not only confirmed the soldier's testimony but revealed her

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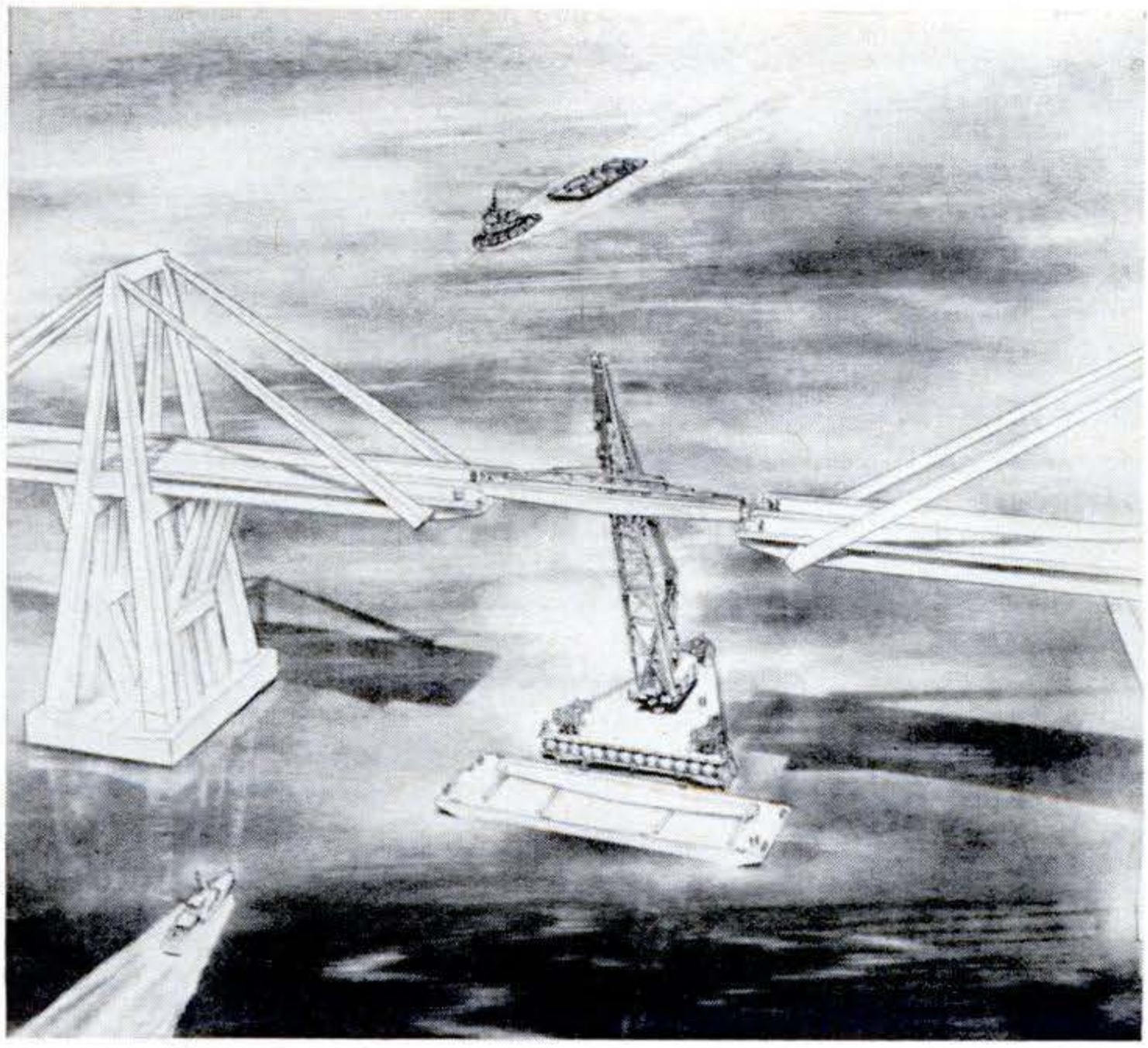

Drawing shows how bridge sections will be lifted into place.

Tower tested before shipment.

GIANT MACHINE TO BUILD SIX-MILE BRIDGE

A Texas tower of the kind used in drilling for offshore oil will be a key tool in constructing a six-mile concrete bridge across Lake Maracaibo in Venezuela. The LeTourneau island will rest on the bottom to support a 250-ton crane. When one section is completed, it will draw up its legs and be towed to another spot.

NATO FIGHTER. The Fiat G-91 at right won for the Italian firm an international competition sponsored by NATO for a light tactical fighter. It can operate off grass strips, can be refueled and re-armed rapidly, and is highly maneuverable.

SPACE SAVER. This spare collapses to a one-inch pancake for stowing in your trunk. A British Dunlop tubeless tire, it is permanently mounted on a flat disk wheel. When needed, it is inflated by a carbon dioxide can. The low-cost emergency wheel, shown here with an ordinary tire, can be driven up to 400 miles at reasonable speeds.

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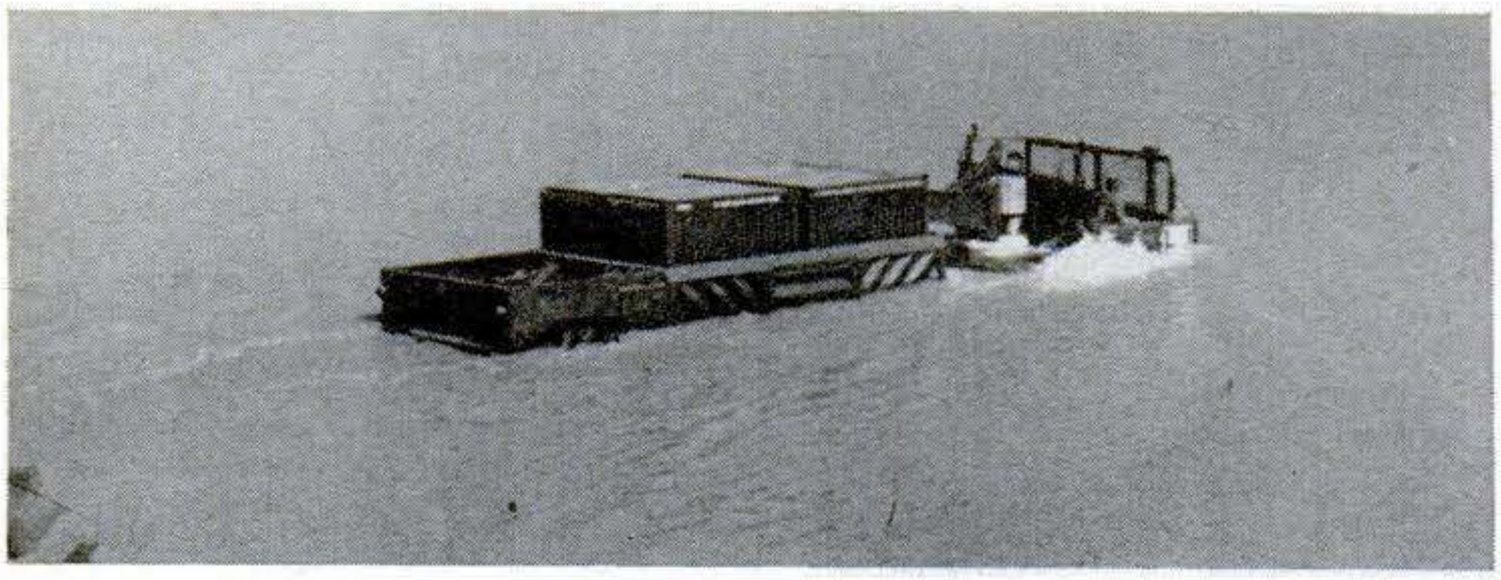


Vehicle takes to water like a duck. Bilge pumps keep floor dry.

Clean bottom is shown as

GOER The Truck That Goes Anywhere

Our Army calls it a new concept in transportation—its G.I. drivers rate it tops in trucks

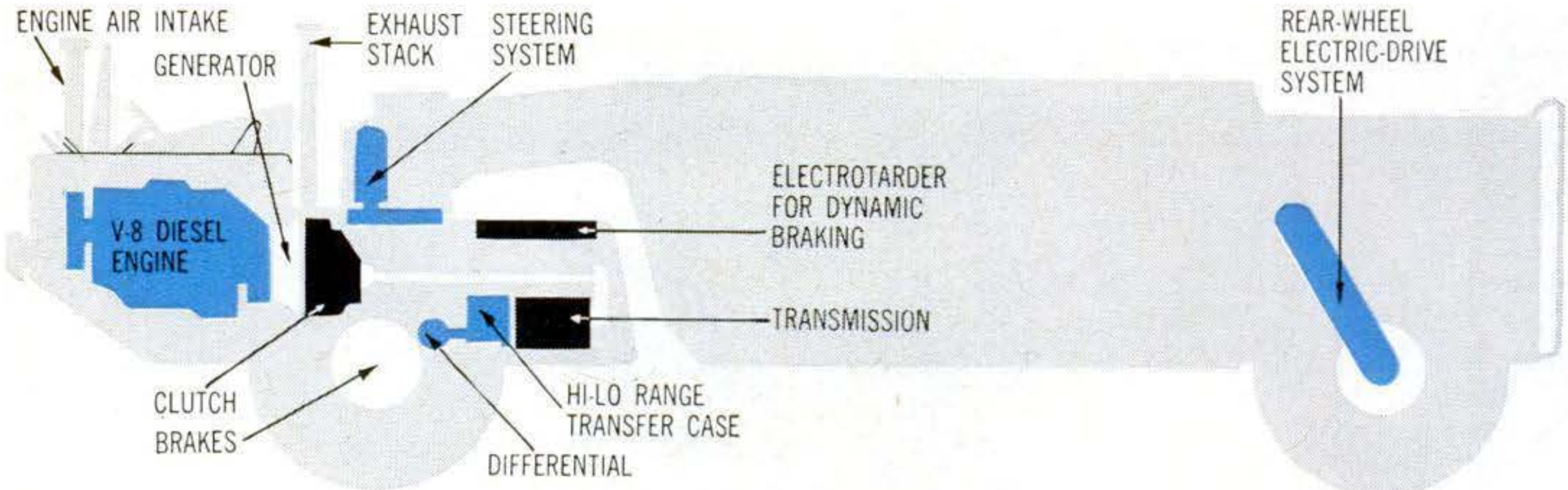
WHEN the military shows off a new vehicle, it is usual for observers to speculate on its possible future uses in civilian dress.

Not with the GOER.

Its 15 tons of truck is made of components that have proved their worth in civilian life on commercial earth-moving and heavy construction equipment.

It carries a load of 15 tons. A tanker version holds 5,000 gallons of fuel. It can refuel five vehicles at one time at a rate of 250 gallons a minute.

In a recent demonstration held by the Armor Board at Fort Knox, Ky., off-



EXOSKELETAL CONSTRUCTION of the GOER is shown in the cutaway drawing above. If it scrapes bottom, there's nothing underneath to get damaged. Tires are the only suspension.

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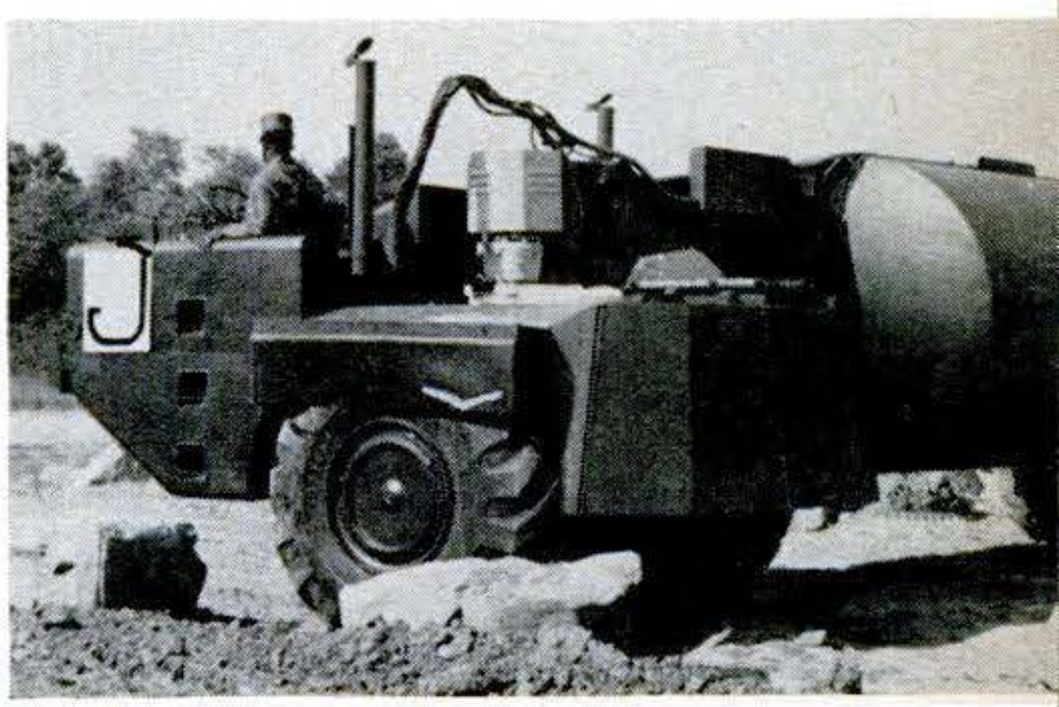
the GOER takes ditches in its stride. Load is 15 tons.

HERE'S A CAPER you wouldn't want to try with your family buggy. For this driver it was just a lopsided bump.



ROCK-STREWN SERPENTINE COURSE is no problem. Tight steering lets tanker version thread its way through.

road maneuvers and obstacle-course trials were the themes of the day. Two LeTourneau-Westinghouse-built GOERS were matched against a variety of the Army's tough-terrain vehicles—from a ¼-ton jeep to a 10-ton, 10-wheeled cargo carrier, with a half-track thrown in for good measure. All carried a full payload.

Challenging them were obstacles of the kind that trucks might have to cross in support of combat troops—steep hills, mud pits, a vertical wall, a hogback, a sand slope, a serpentine rock course, and a log washboard.

The GOER outperformed them all. On the rock course it was equaled only by the Army's agile 800-pound Mechanical Mule. The rest of the vehicles couldn't snake through it.

The hogback was impossible for most of the entrants. One truck that tried it got hung up and became a teeter-totter. For the GOER: no sweat. The sand trap was a breeze. In mud it duck-waddled its way through mire 18 inches deep without getting its belly dirty. Thirty inches of mud browned its bottom a little. None of the other vehicles made it through the 100-foot stretch of ooze.

Then, becoming a real show-off, the GOER took off down the road at 35 m.p.h. At Tobacco Leaf Lake it nosed down a steep embankment, plunged in with a splash, and swam across at three

WADDLING ITS WAY through deep mud, the truck takes a zigzag course—right, then left.

CONTINUED

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m.p.h., powered by the two front wheels. (A propeller may be added in future versions to increase water speed.)

What makes the GOER go anywhere? No one feature can take the credit. First there are the four large, almost six-foot-diameter tires that give a center ground clearance of almost 30 inches. Operating at low pressure (between 15 and 30 pounds), they act as giant shock absorbers. There is no other suspension. In a traction test, the GOER proved its sure-footedness in a tug of war with a truck of about the same gross weight, but having 10 smaller wheels and greater horsepower. The GOER triumphed.

Exoskeletal is what the Army calls the vehicle's unitized, welded construction. Turtles, lobsters, airplanes, and tanks are exoskeletal. You and your conventional automobile are endoskeletal. In your car that means that there's a frame to which flexible body and suspension members are attached. The GOER has no framework or body skeleton. It is a hollow shell in which the working parts are contained. Everything except the wheels is inboard. There is nothing underneath to get fouled by ground obstacles.

GOER CAB has standard truck operating controls. Shift levers are the same. A driver needs no special training to run it.

A bonus of this construction is floatability. Hollow inside, flat as a pancake on the bottom, the GOER takes to water like a barge. Its 274-hp., two-cycle diesel engine is high and dry inside its inboard, watertight compartment. Electric motors are designed to operate in water. A 125-gallon-a-minute bilge pump takes care of water that might enter the cab. The drivers I talked to said they didn't even get their feet wet going across Tobacco Leaf Lake.

Tractor and trailer units in the test-bed GOERS are connected by a yoke that can be unbolted in 30 minutes. Normally only the two front wheels are powered. There are 10 forward speed selections and two in reverse. In first and reverse the rear wheels are automatically powered through an electromechanical drive. Electricity for this assist drive, and for the power-steering motor, comes from a 518-volt AC generator that is coupled directly to the engine.

Wagon steering. Maneuvering the GOER is not done by turning the front wheels in relation to the vehicle. Instead, the entire tractor unit turns with respect to the rear unit—like the front axle and wheels of a farm wagon. When the driver turns his steering wheel, an electric drive unit in the yoke goes into action and rotates the cab section in the desired direction. At 90 degrees in either direction, a cam-operated limit switch automatically stops the steering motor. With this positive-powered wagon steer, the GOER can make a 360-degree turn within its own length of 36 feet.

Another advantage of wagon steer is apparent in mud, sand, and snow. Turning alternately right and left, the driver can force the wheels around to find a better footing—duck-walking his way through. If one wheel starts slipping, he has the further assist of a power-transfer differential. This diverts power from the wheel with poor footing to the wheel that is taking hold.

Extra braking is supplied by an electrotarder. This places a load on the generator, which is in line with the engine. Its effect is the same as using the engine as an added brake.

When the GOER tied up its bag of tricks by swimming the lake, one interested spectator, Lt. Gen. Arthur G. Trudeau, Chief of Army Research and Development, looked pleased. He had the answer to a previous complaint concerning heavy trucks, for which off-road mobility is claimed because they can "go across pasture land—if it isn't too damp." —*Herbert O. Johansen.*

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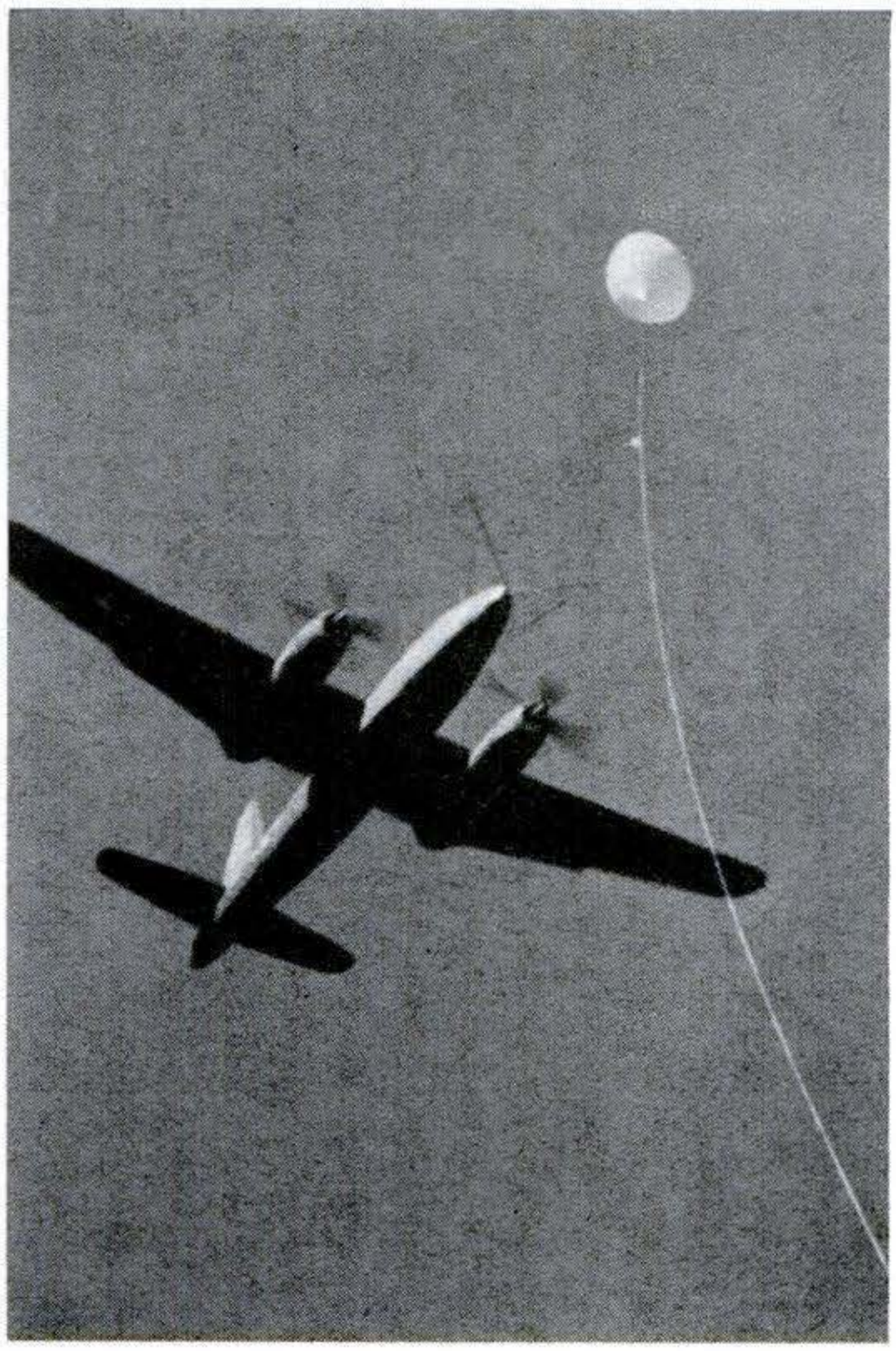


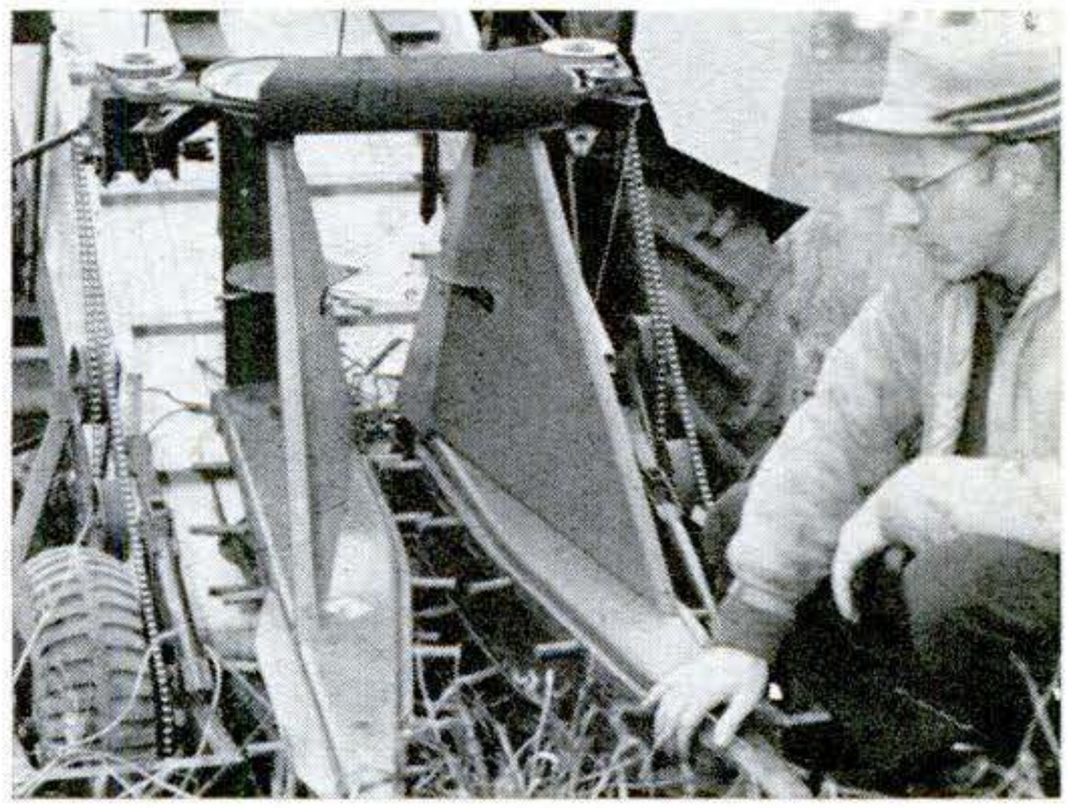
Plane approaches line on balloon at 145 m.p.h.

. . . lifts man attached by harness on other end.

AIR-SEA RESCUE ADAPTED TO FAST PLANES

A new method of swift rescue from the sea is being developed by the Marine Corps. It employs a nylon line suspended from a helium-filled balloon and hitched at the other end to a harness around the man to be saved. A special yoke mounted on the nose of the plane intercepts the line and winches the man into the craft. Here it is being tried, for the first time, over dry land at Quantico, Va.

BRITISH RACE TRACK. Here's a combination crossover and interchange on the new London-Birmingham Motorway (from left to right in the photo). There is no speed limit on its 90 miles of dual lanes. Cars on it have hit 157 m.p.h.



SWIFT BEAN PICKER. This machine harvests beans in half the usual time. Rubber fingers lift the pods and a blade cuts the stems—an operation that used to take three steps. Cornell scientists built the device to reduce costs.

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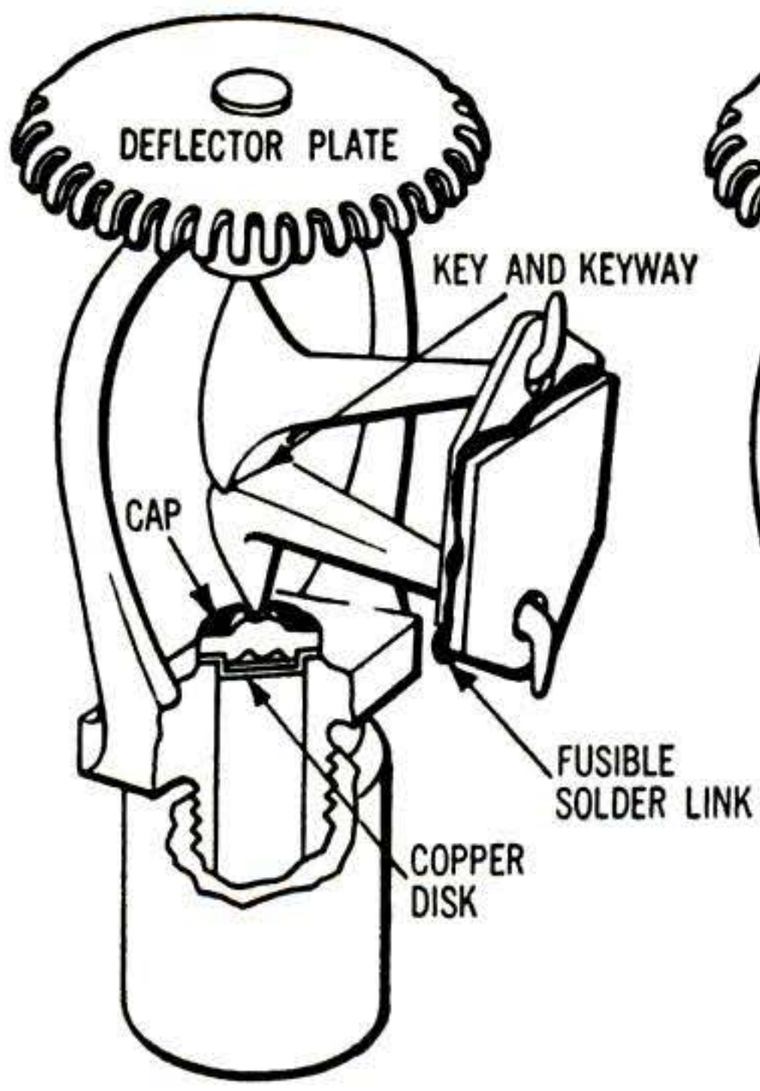
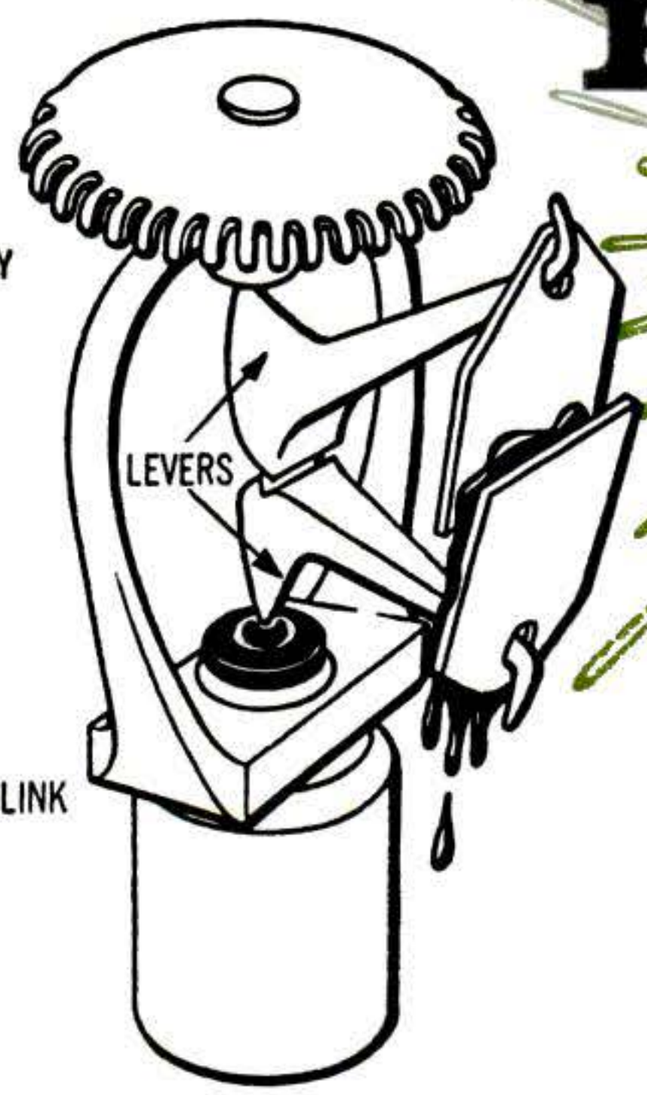
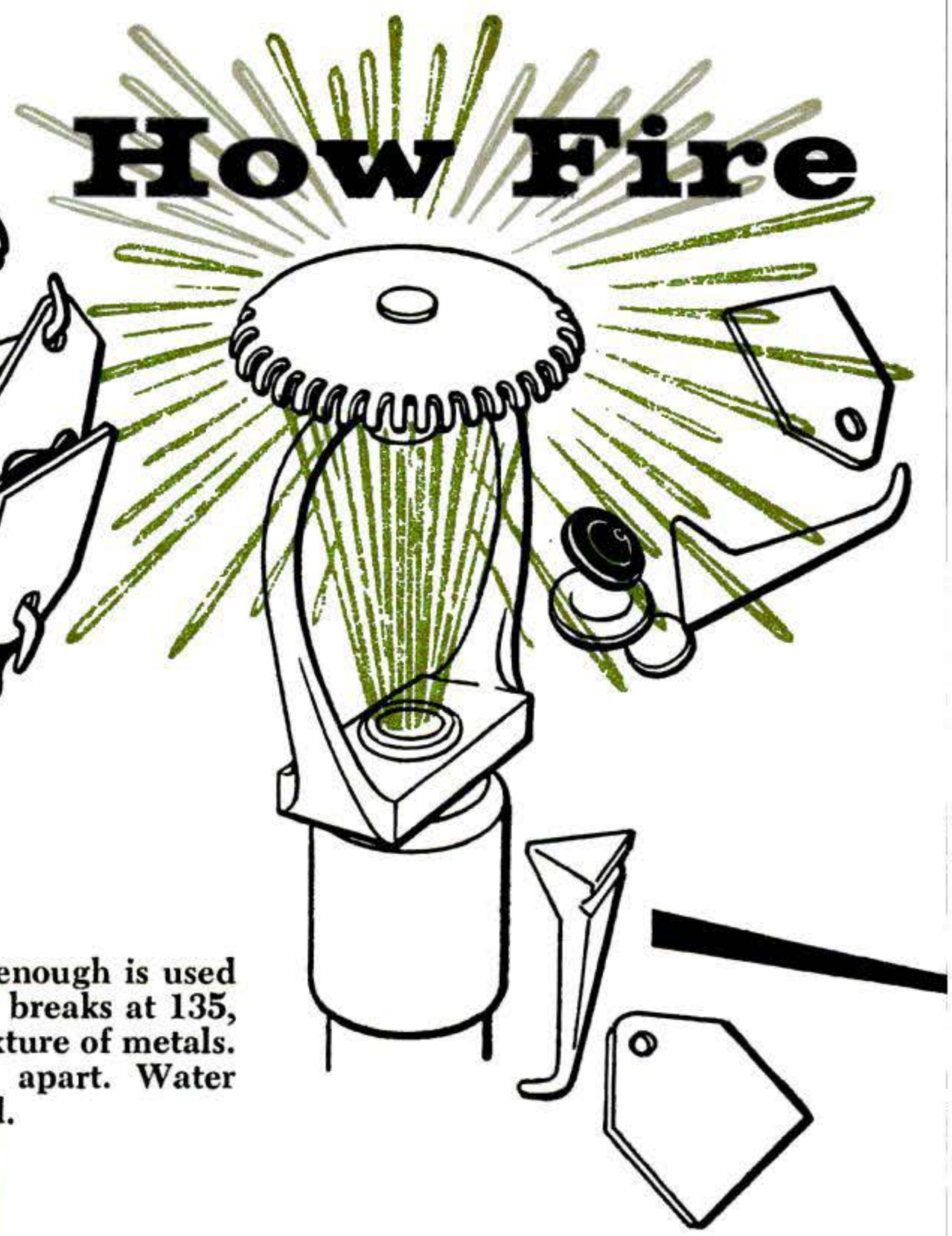
How Fire





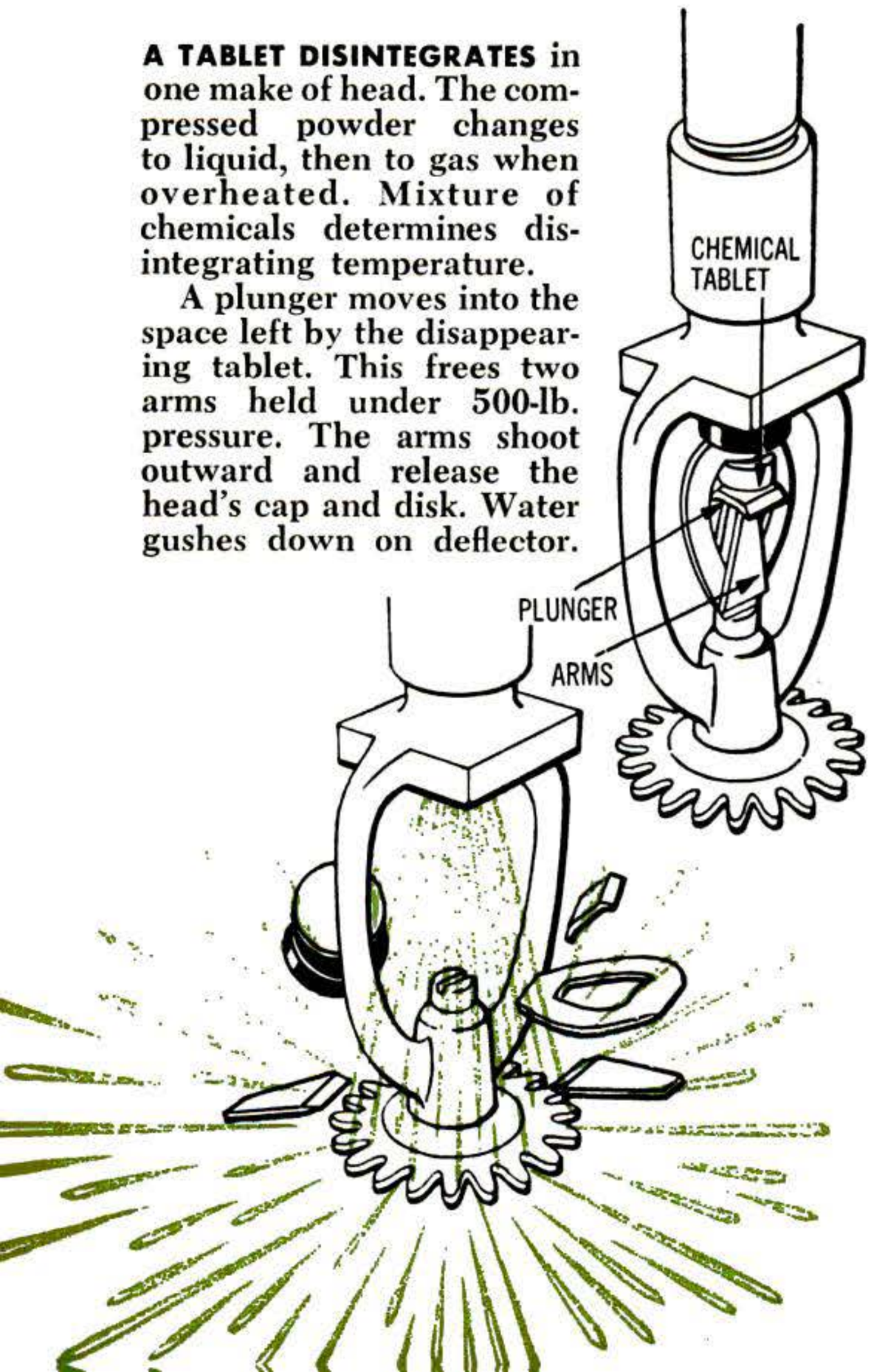


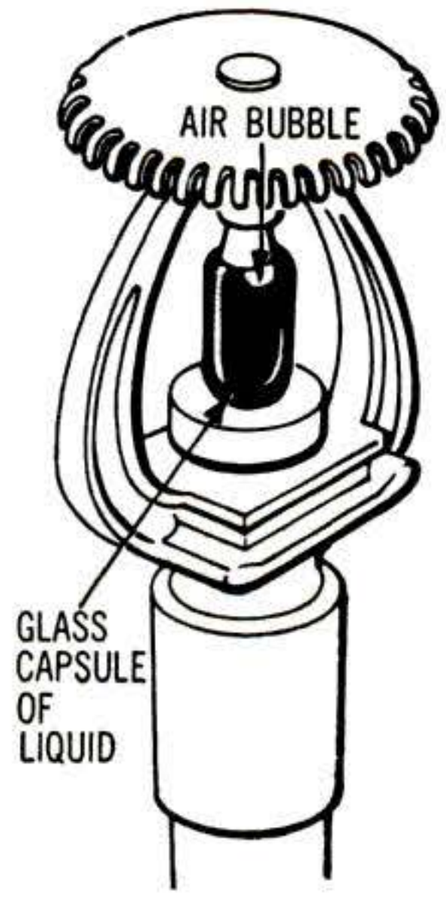
A FUSIBLE LINK THAT MELTS when a fire gets hot enough is used on most sprinkler heads. Made of solder, the link breaks at 135, 150, 160, or 165 degrees F.—depending on its mixture of metals. Two levers, no longer held under tension, fly apart. Water pushes a disk and a cap aside as it spurts upward.

How fire opens a sprinkler head

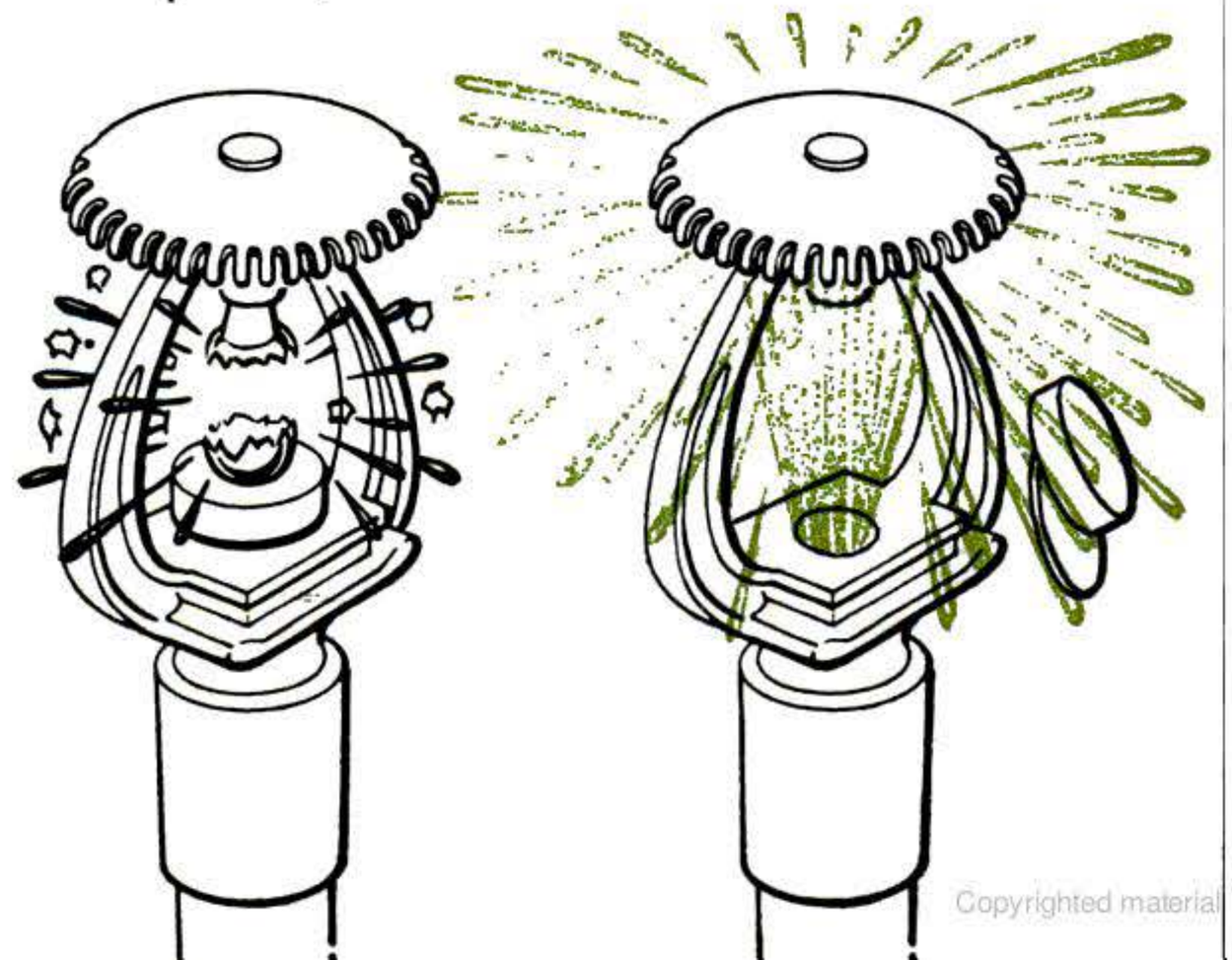
A TABLET DISINTEGRATES in one make of head. The compressed powder changes to liquid, then to gas when overheated. Mixture of chemicals determines disintegrating temperature.

A plunger moves into the space left by the disappearing tablet. This frees two arms held under 500-lb. pressure. The arms shoot outward and release the head's cap and disk. Water gushes down on deflector.





A GLASS CAPSULE BURSTS in another make of head. Heat expands a special liquid until there is no air space left and the glass shatters. Bursting temperature is set by filling a capsule with liquid at the bursting temperature. As the liquid cools (and contracts), a bubble appears. The higher the bursting temperature, the larger the bubble. When the capsule goes, cap and disk pop off as the water rushes out against the deflector.



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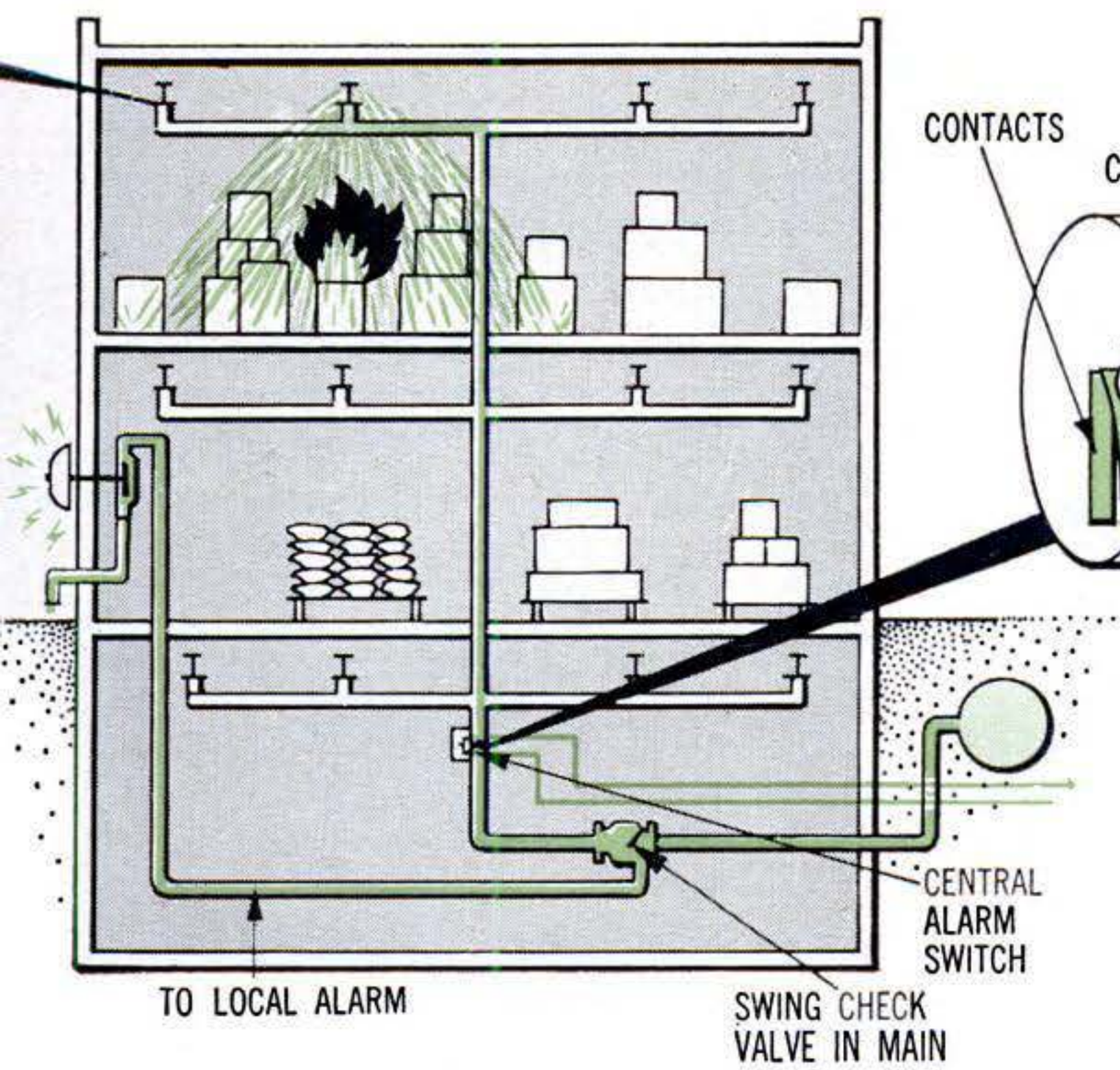
Sprinklers Work

ABOUT 400,000 people have died in building fires in the past 60 years. Only two were in buildings protected by automatic sprinklers. Both were smokers who dozed off and suffocated; the smoldering material around them never got hot enough to set off a sprinkler.

A completely automatic system does three things almost simultaneously: It sprays water on the fire, rings a bell in the building, and alerts a central office or a fire house, or both.

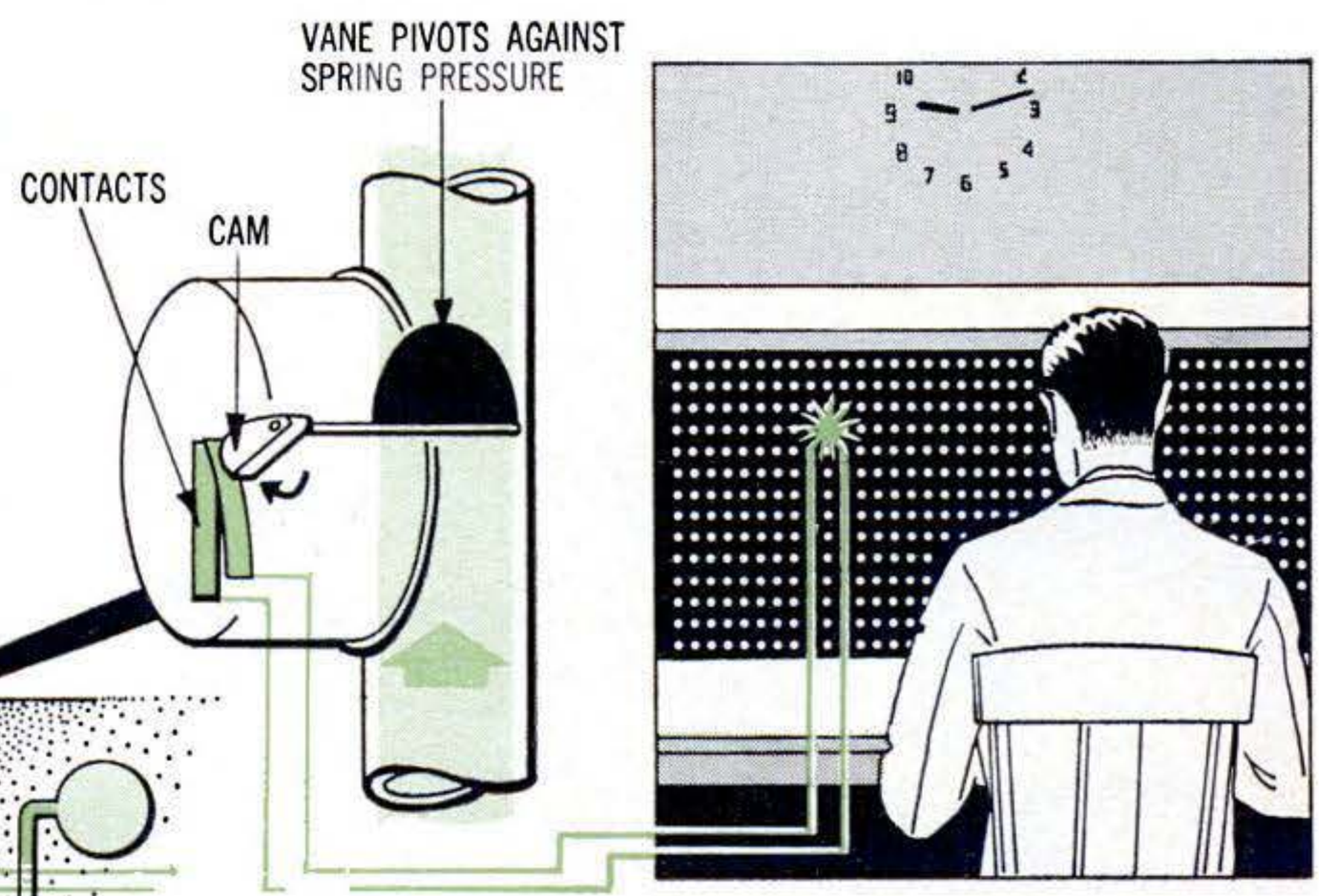
The "wet" type shown here is the most common. Water stays in all the pipes, ready to burst out instantly at a rate of 500 to 750 gallons per minute. A "dry" system (used where water might freeze) has compressed air inside. When a head fuses, the air escapes, opening a valve that lets water flow through the pipes.

The first automatic head was patented in 1874 by Henry Parmelee of New Haven, a piano maker. It had no deflector—this was added eight years later by Frederick Grinnell of Providence. In 1951, deflectors were reshaped to shoot a fine spray directly downward, making sprinklers one third more effective.



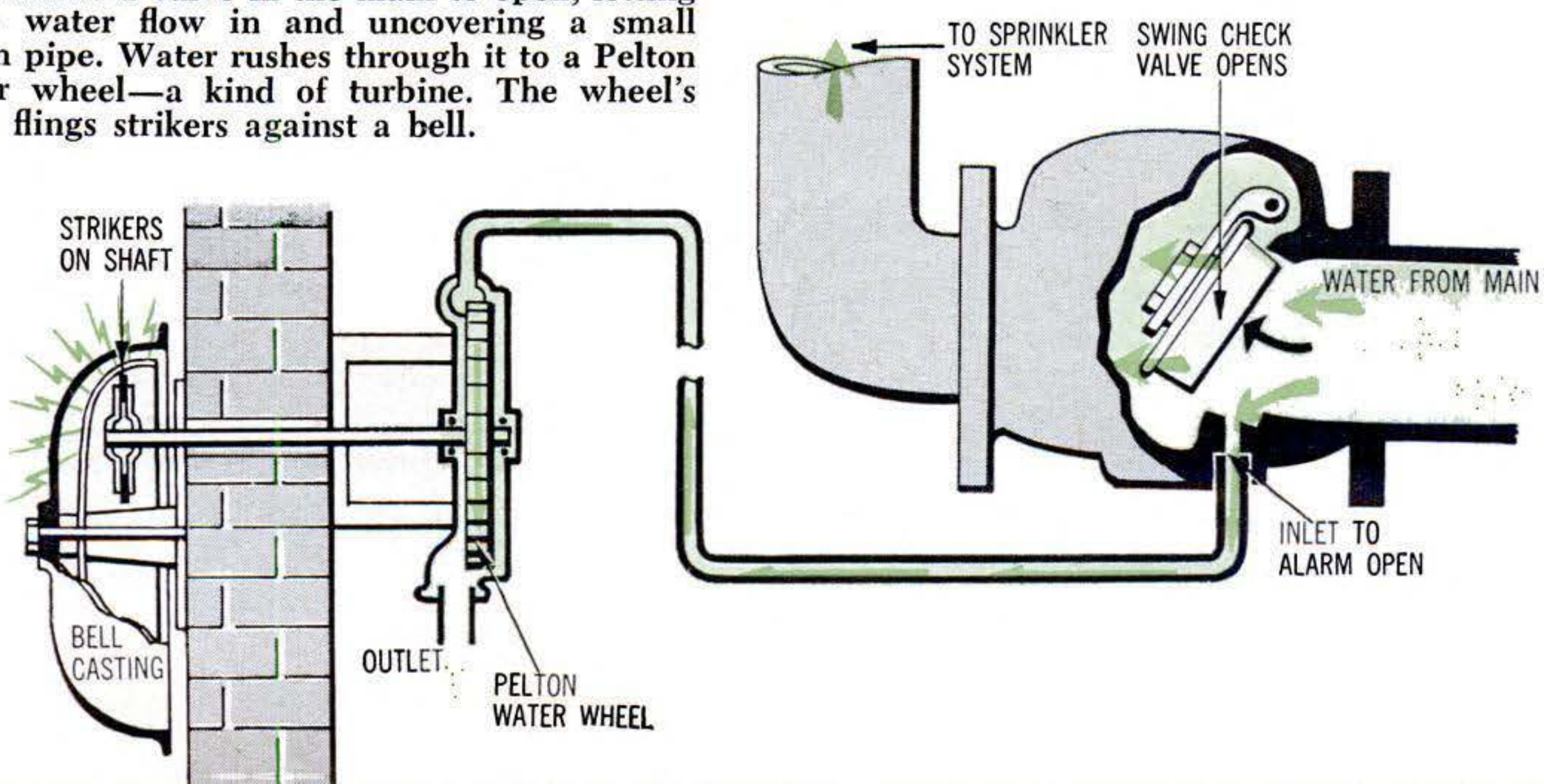
How the local alarm works

A STREAM OF WATER powers mechanical alarms on the walls. As water pours out of the open head, pressure drops inside the sprinkler pipes. This causes a valve in the main to open, letting more water flow in and uncovering a small alarm pipe. Water rushes through it to a Pelton water wheel—a kind of turbine. The wheel's shaft flings strikers against a bell.



How the central alarm works

AN ELECTRIC SWITCH signals the central station of a service like American District Telegraph Co. Water surging through a main sprinkler pipe to the open head pivots a vane and shaft against spring pressure. A cam atop the shaft pushes two contacts closed. The alarm signal automatically travels through the central station to the appropriate local fire house.



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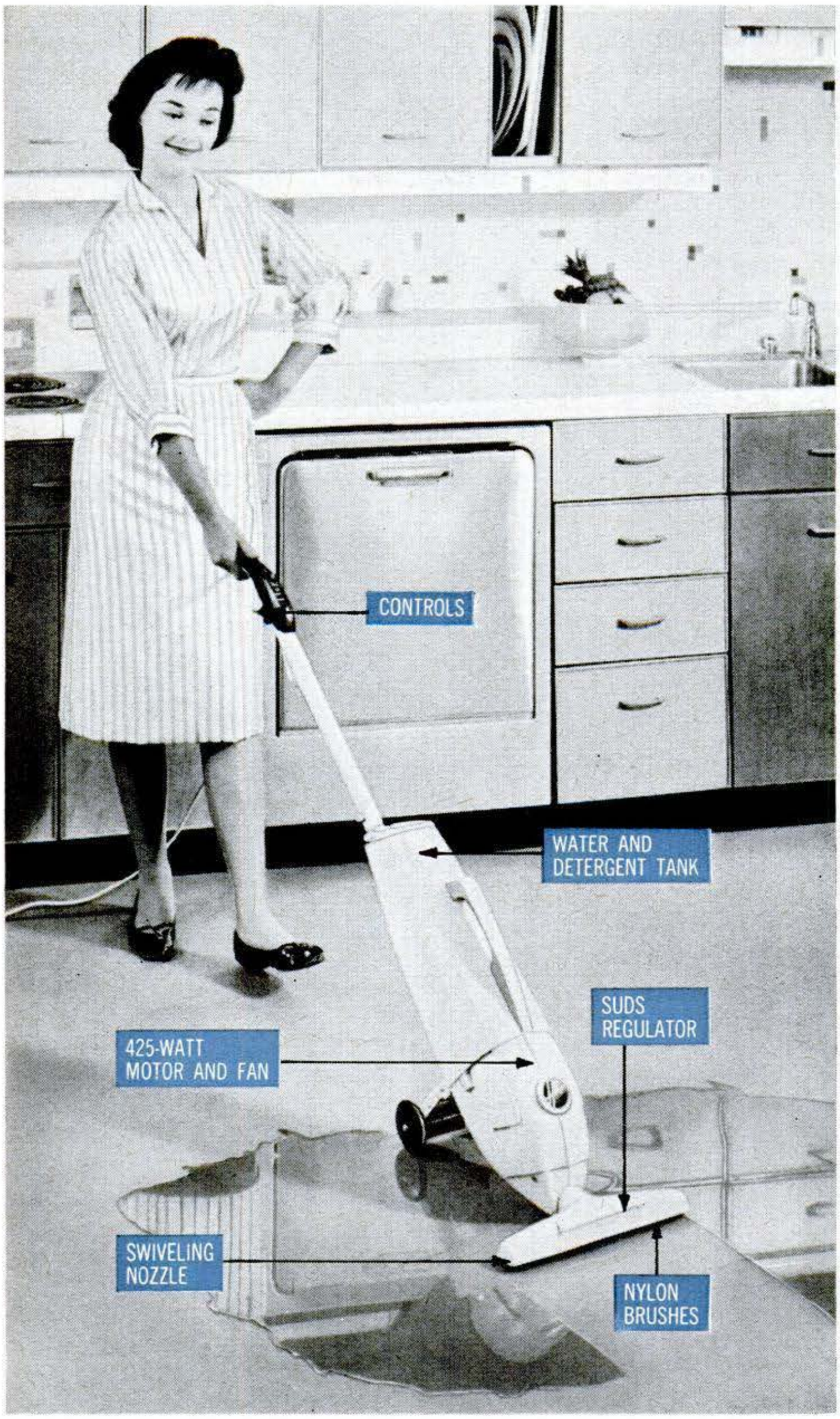
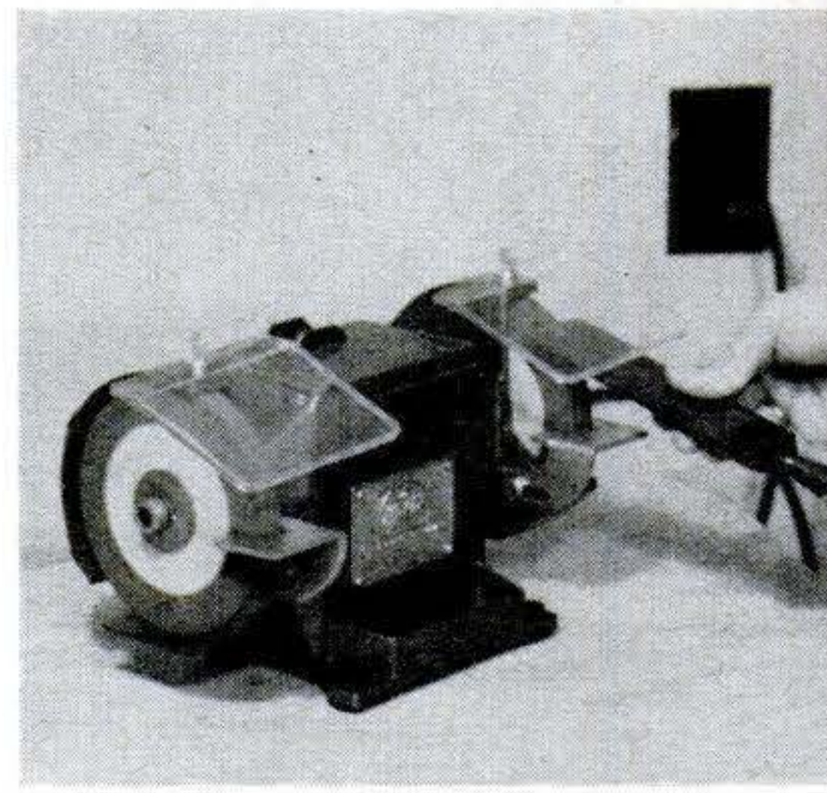
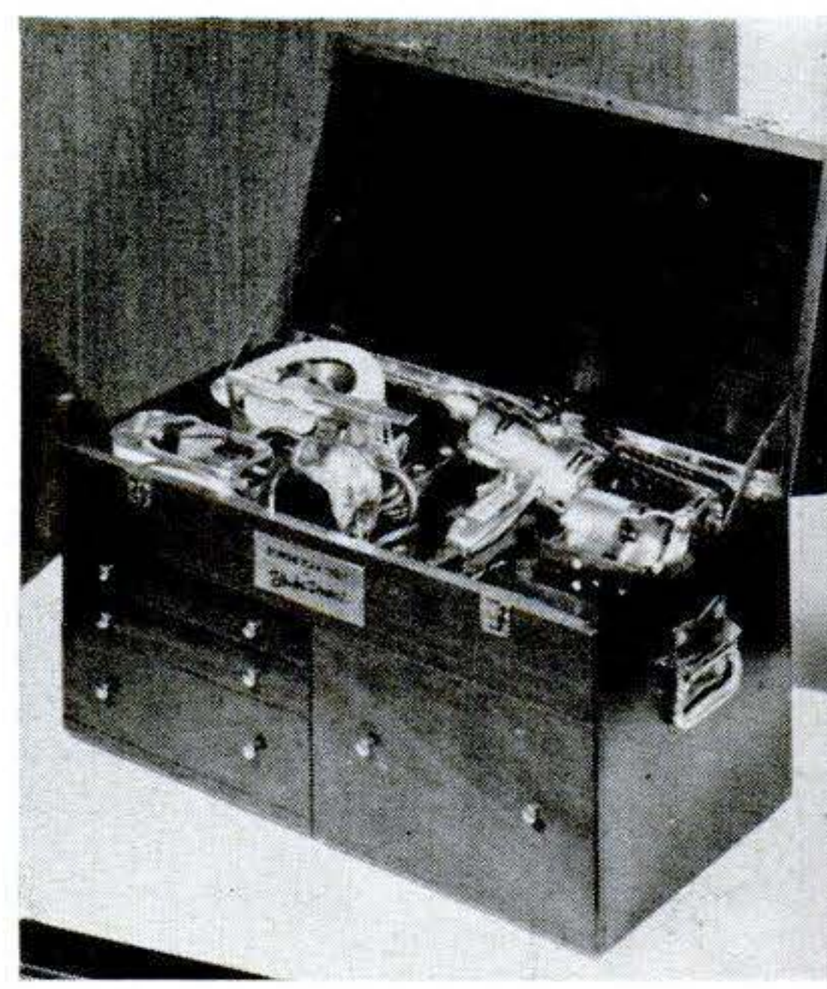


Electric Floor Washer

This new machine spreads sudsy water on your floor, scrubs it for you, and then vacuums it dry. Dirty water is sucked up into a separate tank so you don't use it over again. The amount of suds is regulated at the nozzle. Your only work is filling the reservoir with water and detergent and then pushing the brush to loosen dirt and grease. A switch in the handle controls the cycle. $79.95. Hoover Co., North Canton, Ohio.



BENCH GRINDER is small, compact—10 inches long, 7¼ pounds—for home workshops. It's of die-cast aluminum with rubber feet and bolt holes. It sharpens shop and garden tools; sands; polishes; and wire-brushes with a change of wheels. $19.95. SpeedWay Div.-Thor, 1421 Barnsdale Rd., LaGrange Park, Ill.



POWER CHEST holds a portable power driver and a selection of attachments. The case is brass-fitted mahogany. Attachments include circular saw, jigsaw, sander, rotor-hone, horizontal stand, table, mixer, bits. Complete, $354.50. Black & Decker, Towson, Md.

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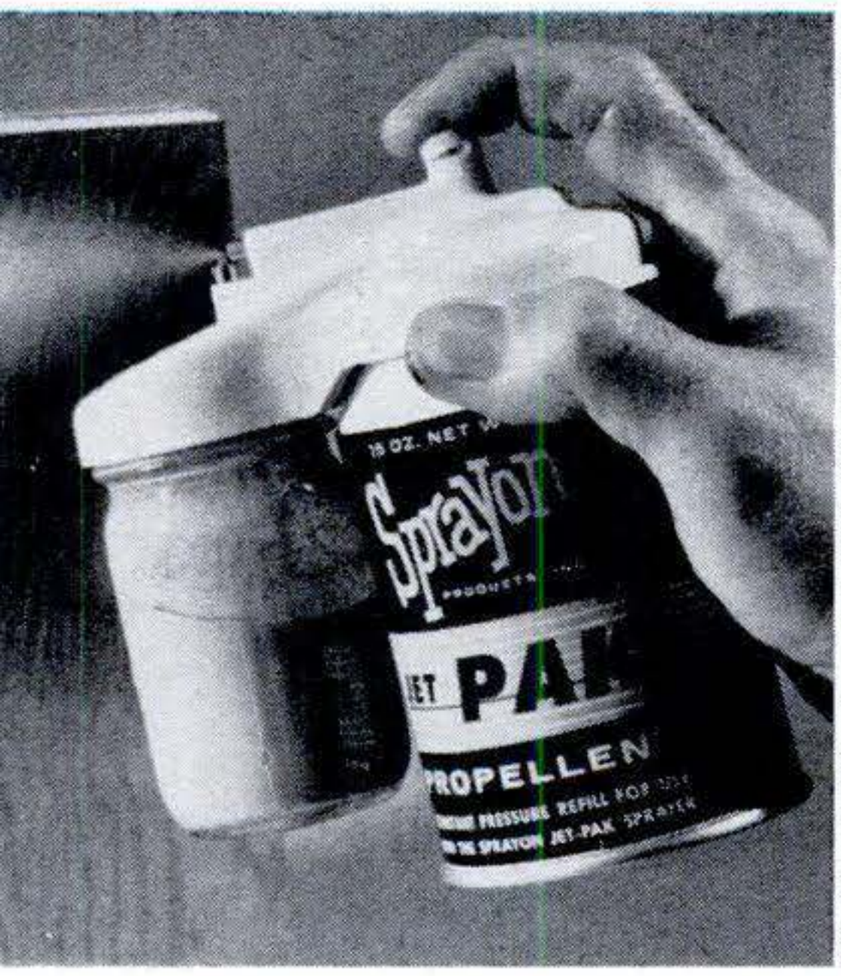
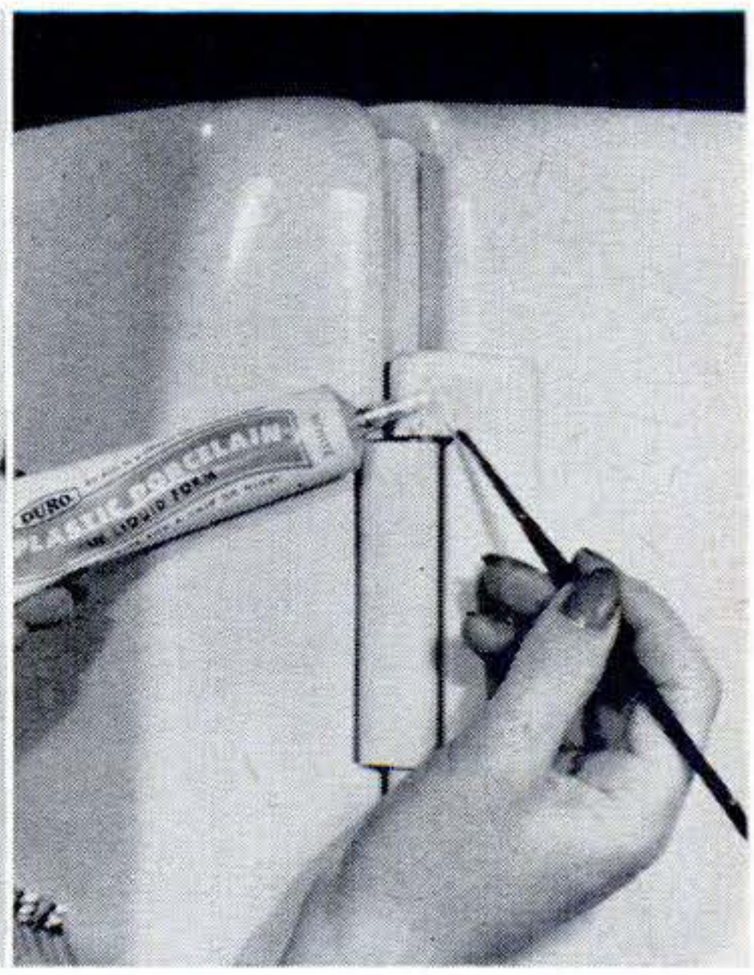
Snap-On Tools Fit Power Drill

A twist, a snap, and these new tools lock into place on a power drill. Four of the line have been announced initially: a five-inch circular saw, jigsaw, orbital sander, and hedge trimmer. Wall holders (shown in the photos) are available for each. They can be fastened together in a single unit for hanging inside a cabinet door, on your shop wall, or on a perforated panel. The Snap/Lock saw and sander attachments sell for $16.95, the trimmer for $19.95. They fit Skil quarter-inch drills ($16.95) and some other makes. Skil Corp., 5033 Elston Ave., Chicago.



SPRAY PACK consists of a pushbutton-valve head, jar for paint or other liquid, and replaceable aerosol can. It uses any liquid you thin to the consistency of light cream. Sprayon Jet Pak complete, $3.95; refill, $1.79; extra jar, 15 cents. Sam Flax, 25 E. 28th St., NYC.

SHINE BOX with foot rest now houses this electric shoe polisher. It's made of dovetailed beechwood, sits on short legs. With plug-in motor unit, two brushes, and buffer, it sells for $23.50; box alone, $4.50; shine kit without box, $19.95. Ronson Corp., Woodbridge, N.J.



LIQUID PORCELAIN comes in tube for repair and touch-up of fixtures and appliances finished in white porcelain. It mends breaks and worn spots on refrigerators, ranges, cabinets, and bathtubs. 97 cents. Mrs. Dorothy Damar, 769 Damar Bldg., Elizabeth, N. J.

CONTINUED

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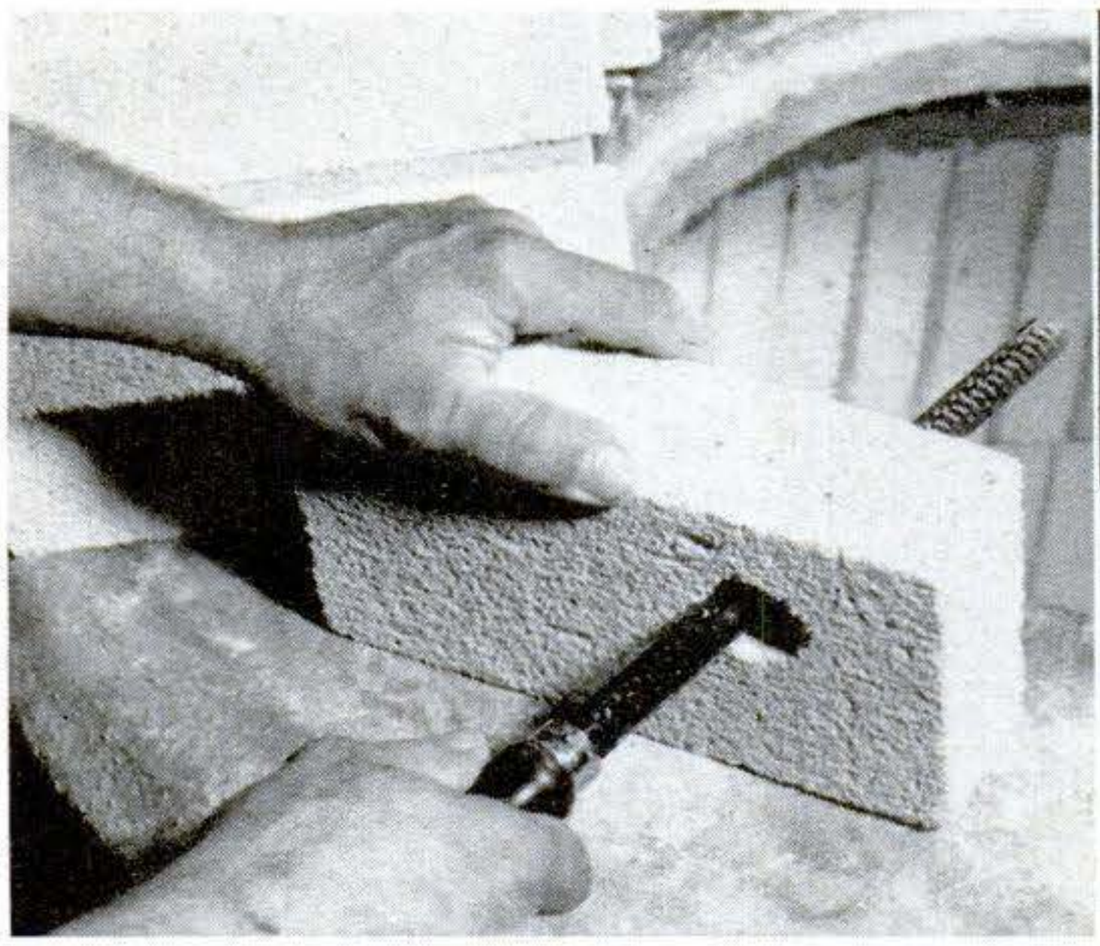
New Small Cycle Has Snappy Pickup

This lightweight Super-10 is Harley-Davidson's newest two-wheeler. Its 10-cu.-in. engine develops over six hp.; a five-hp. version is also made.

New intake- and exhaust-port design boosts acceleration. The two-cycle engine goes up to 100 miles on one gallon. A two-coil AC generator energizes ignition and lights. The piston and cylinder head are aluminum. The three-speed transmission has a multiple-disk clutch with 55 foot-pounds' torque capacity. Price, $478 f.o.b. Harley-Davidson Motor Co., Milwaukee.



NEWEST CUTTING TOOLS by the makers of Surform files and planes are in the form of a round hand file and a drum you use in a quarter-inch power drill or drill press. Like other tools in the line, each is equipped with multiple cutting teeth with individual throats through which chips pass without clogging. They shape wood, hardboard, composition, sheetrock, plastics, and other materials. Used in a drill press, the drum is an effective router for making rabbets. Price, $2.29 for either. The Stanley Works, 111 Elm St., New Britain, Conn.

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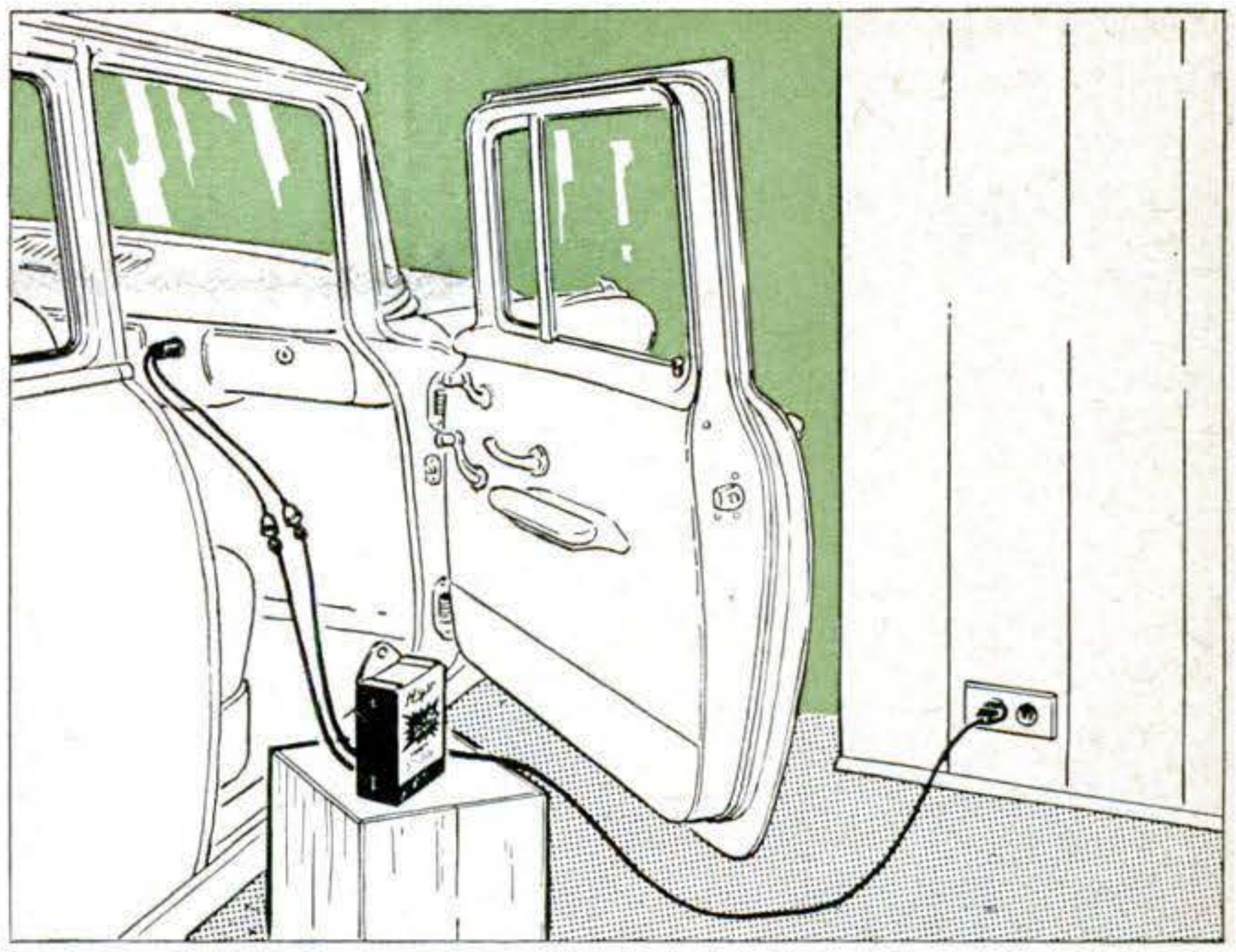
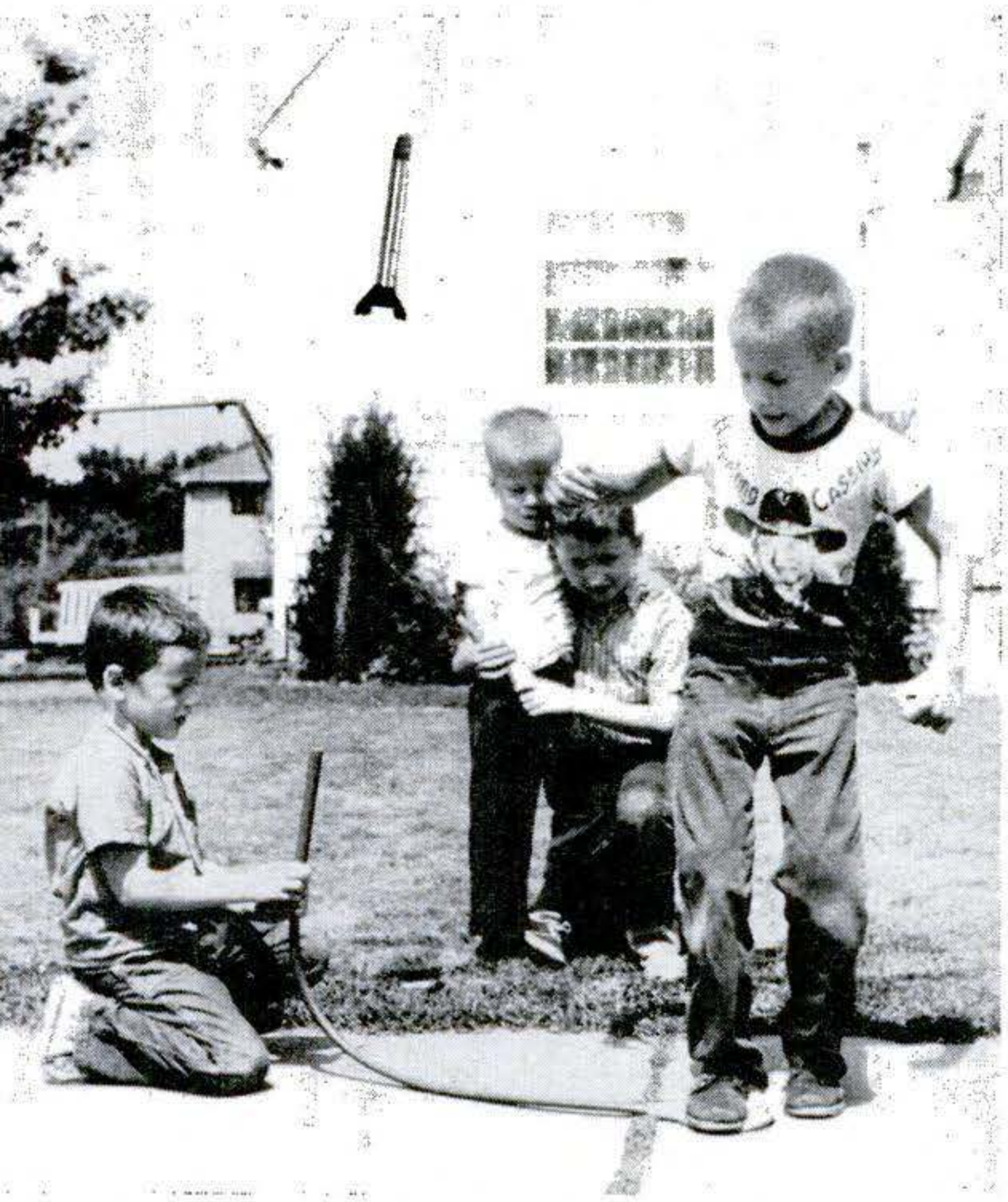


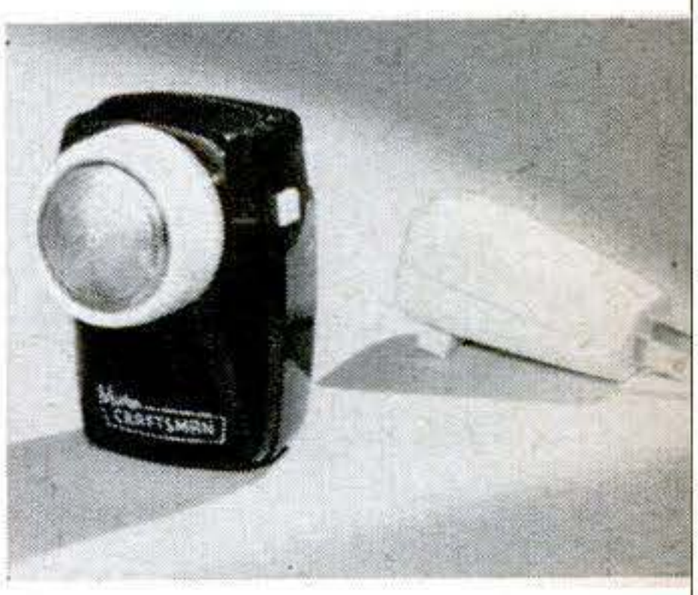
DASHBOARD CHARGER works on 115-volt AC through your car's cigarette lighter. It has a dash-plug unit that you attach to a pair of clips that also can be used for connecting to the terminals of a radio, flashlight, or outboard-motor battery. Its output, rated at two amps, tapers off as the battery is recharged. A buzzer lets you know when charging is complete. Price, $5.98 for 12-volt model, $4.98 for six-volt model. The Grant Co., 2735 N. Ashland Ave., Chicago.



STOMPIN' ROCKET shoots high into the air when your child jumps on the bulb on its launching tube. Ordinary stomps will send it 60 feet or more into the air, hard ones up to 300 feet. Launcher with three eight-inch rockets, $2.49. Rempel Mfg. Co., Akron, Ohio.

WATERPROOFING LIQUID becomes rubber when you spray or brush it on a car roof, tarpaulin, or hunting jacket. Rubbercote comes in pints with sprayer at $2.95, quarts for brushing at $5.75. Stay-Tite Products, Cleveland.

NEW SHAVER runs on a rechargeable battery. Plug it and its charger into a 115-volt AC outlet. Mr. Craftsman sells for $16. Sears, Roebuck & Co., 925 S. Homan Ave., Chicago.



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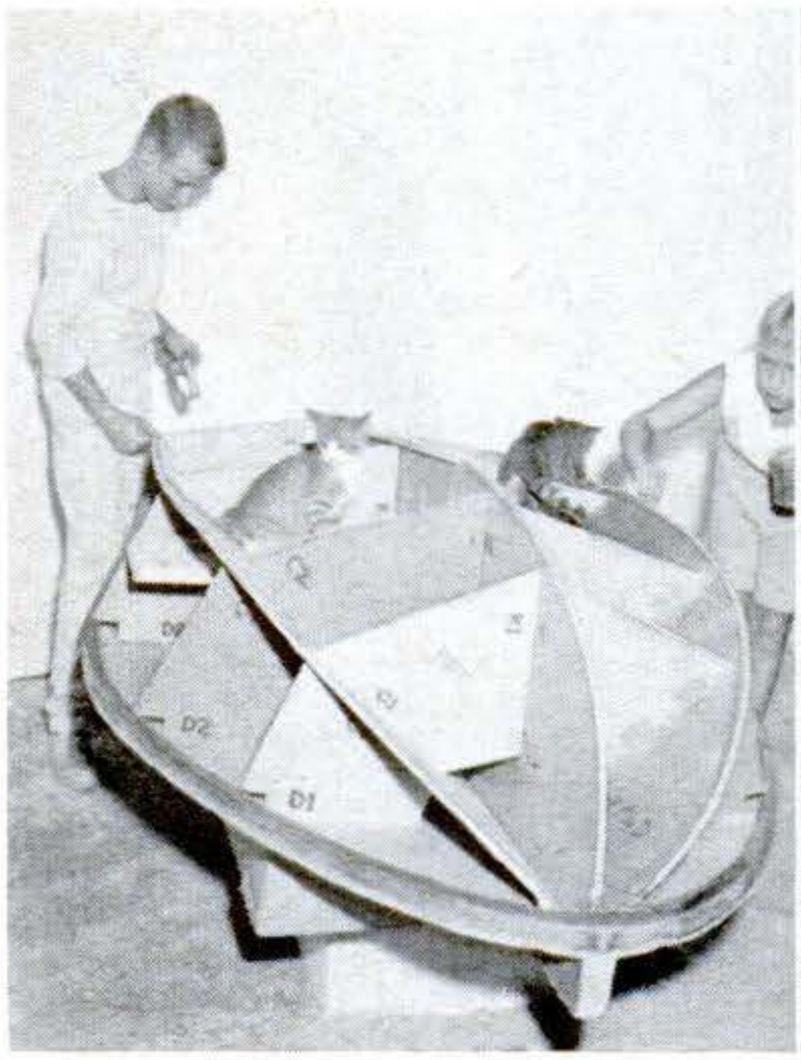
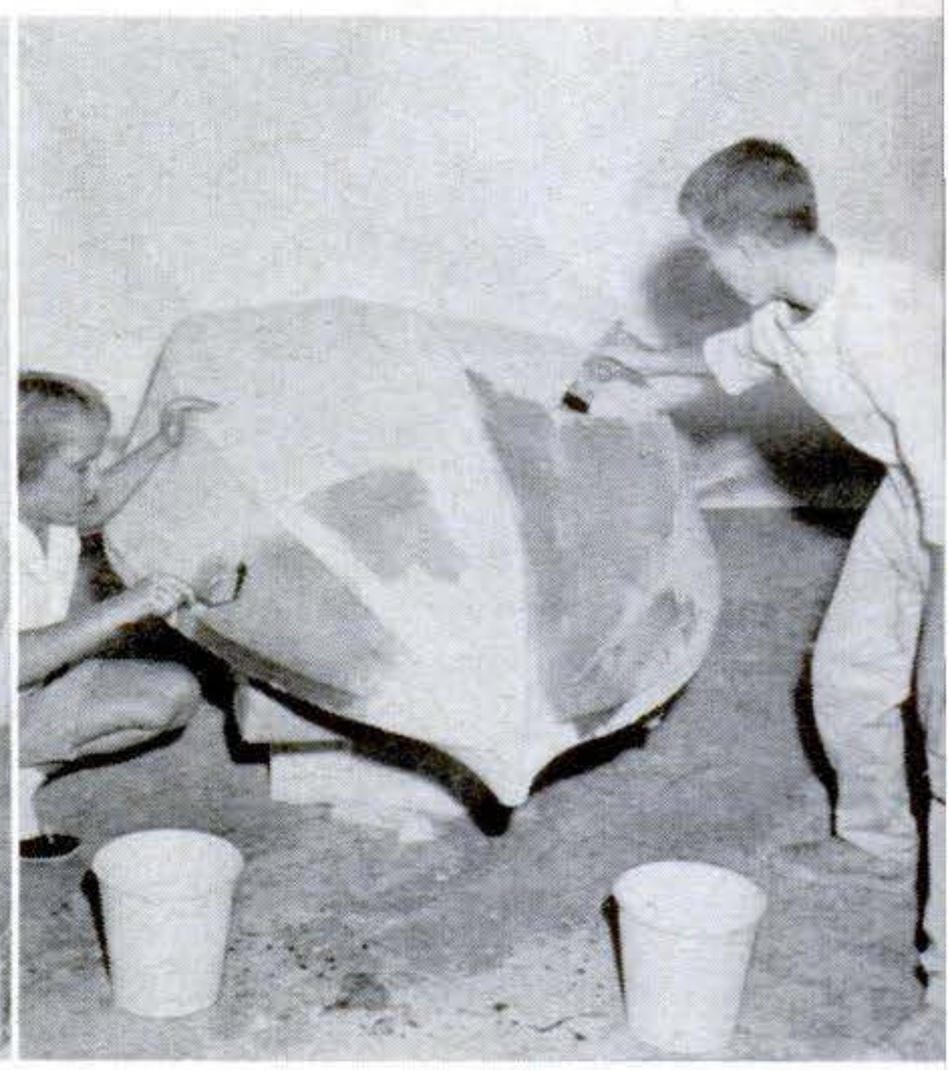
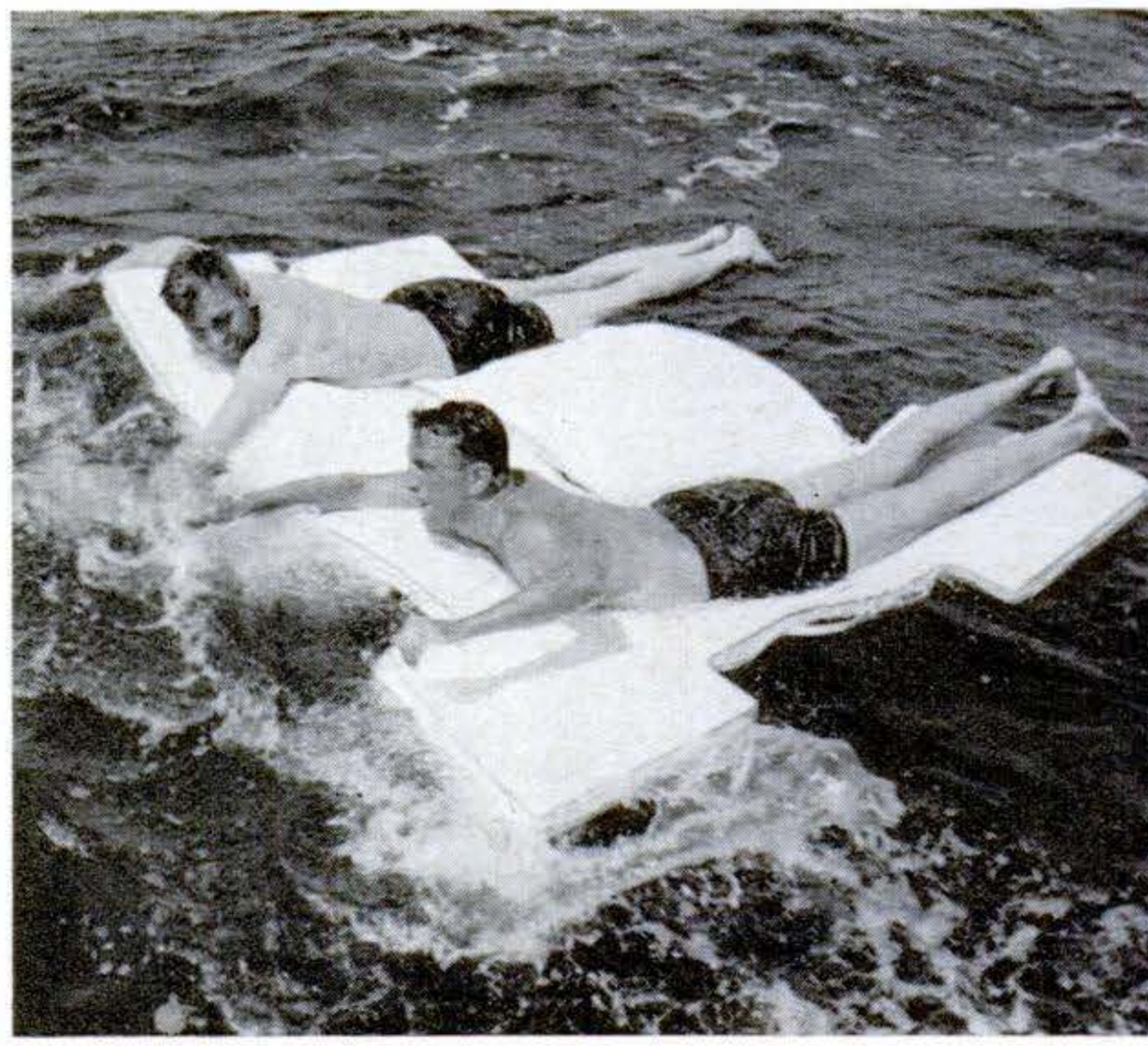




Kit Boat Uses Cardboard Form

Corrugated cardboard, die-cut and numbered, forms the frame of a fiberglass dinghy mold. To it you fasten a wooden breast hook, transom, seat, gussets, and gunwales. Pull the cotton-jersey "sock" over this and harden it with resin. Two layers of fiberglass and resin go on, then a wood keel and rub rails. The cardboard is pulled out. Kit for 6½-foot dink above is $89. Also offered are two larger dinks and an outboard-runabout kit by Sock Boat Corp., Cold Spring Harbor, N. Y.

CONVERTIBLE HARDTOP. Tilt back the molded fiberglass top and it's easy to step out of this outboard. Five models, all white and available with rear and side curtains, fit 14- to 20-footers. Prices start at $115.95. Seabreez Marine Products, Sugar Creek, Mo.



CUSHIONS DOUBLE AS RAFT. When boat cushions of Ensolite, a vinyl sponge, are thrown overboard they float. Three cushions snapped together to form a four-by-eight-foot raft easily support two people. Made by U. S. Rubber, the vinyl can't absorb water and will not burn.

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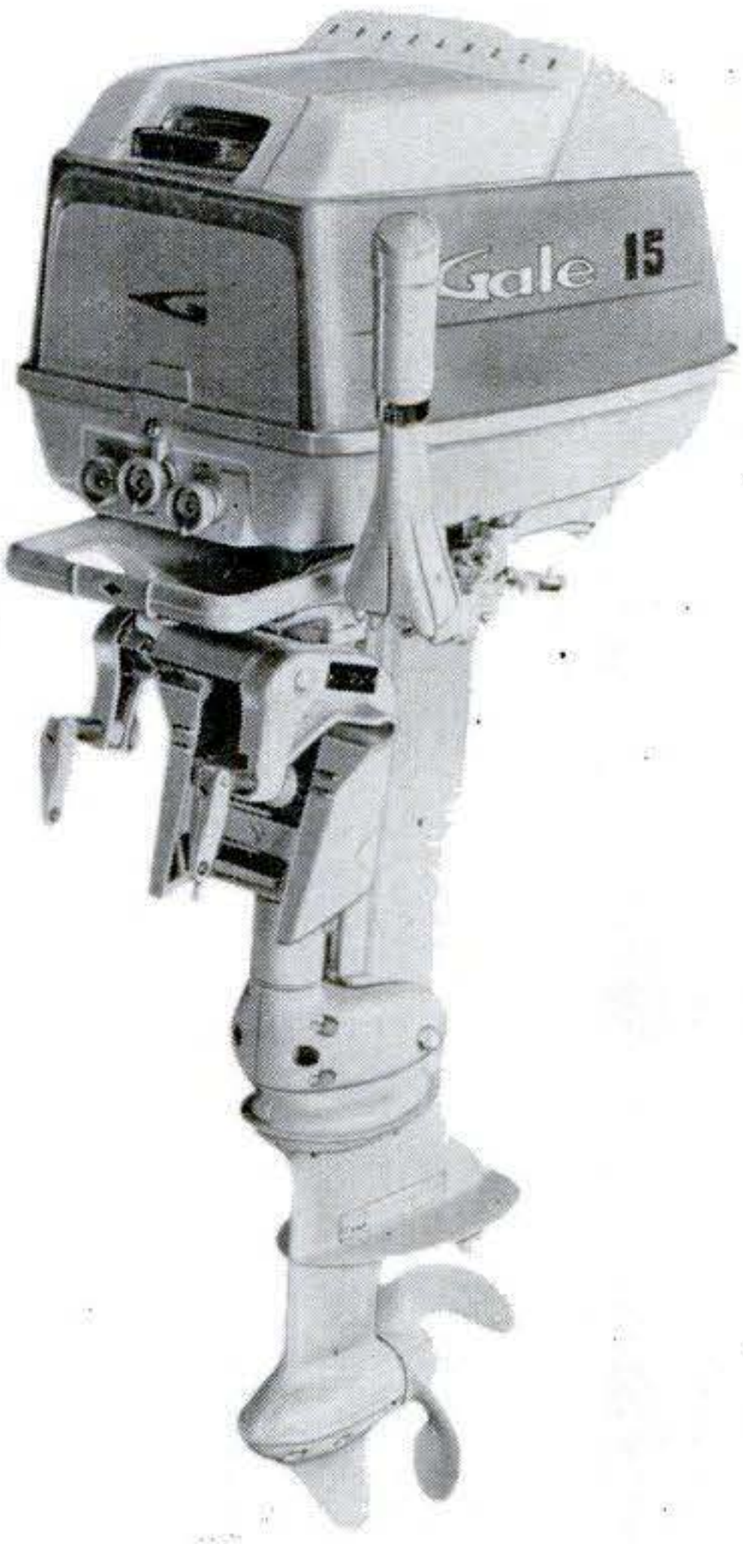
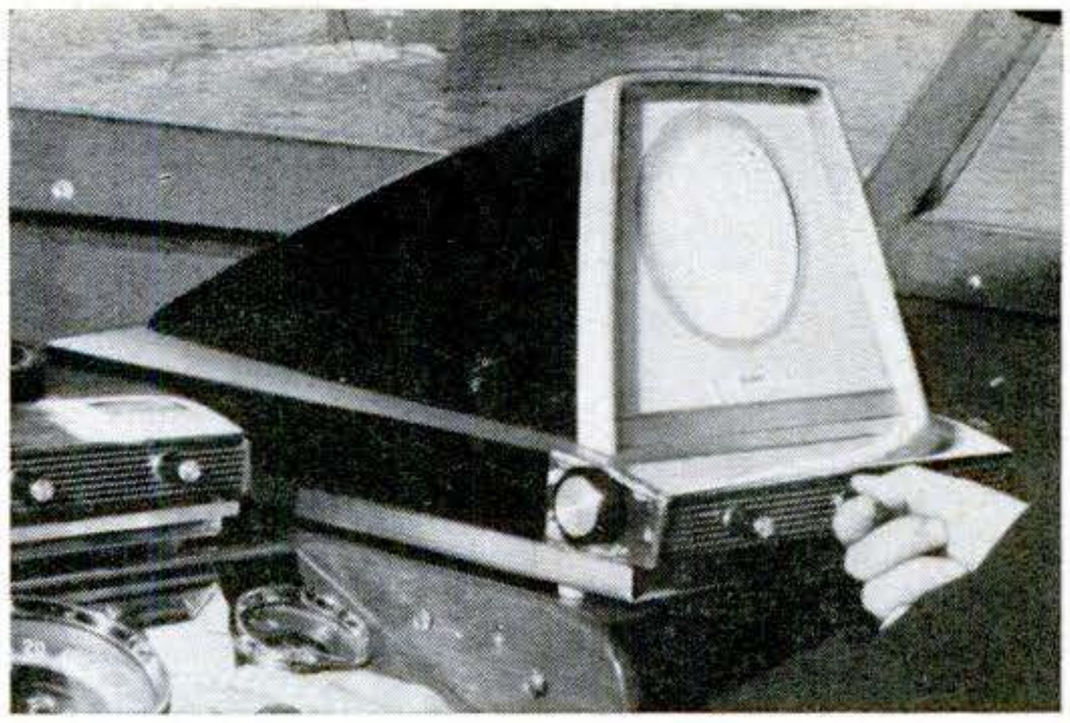
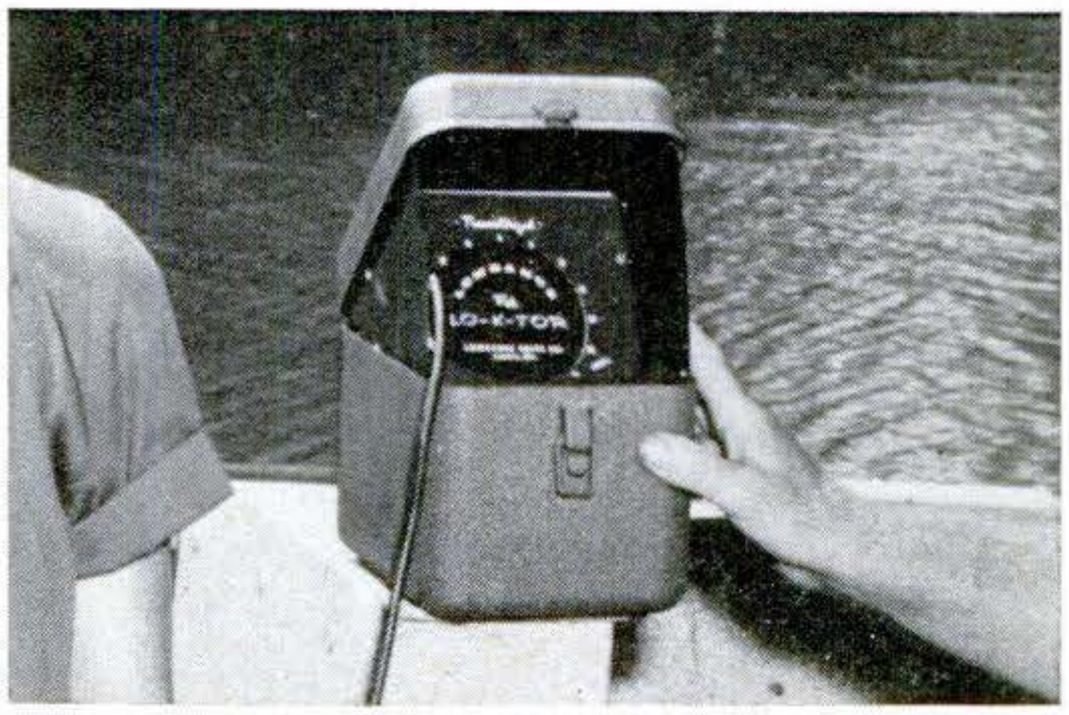


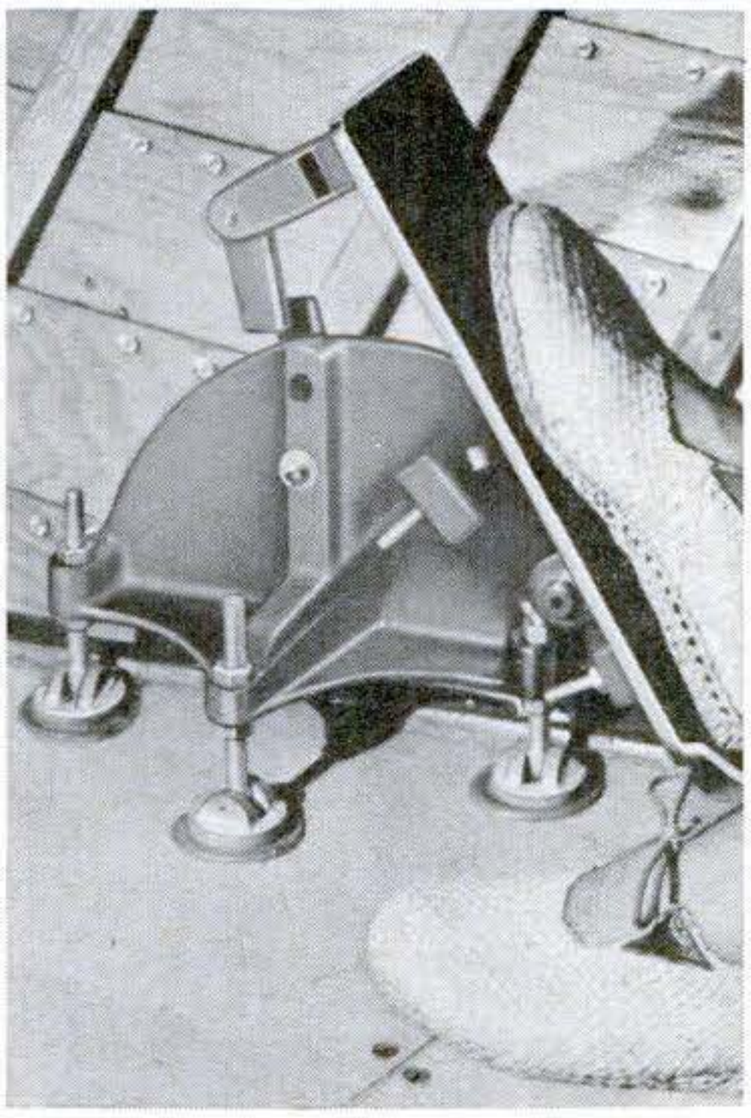
NEWEST 15-HP. OUTBOARD. Designed for sportsmen, this Gale motor weighs a modest 77 pounds. The two-cylinder two-stroke has a rubber slip clutch and a one-piece, snap-on fiberglass shroud. Made by Gale Products, Galesburg, Ill.



SMALL-BOAT RADAR. This set "sees" 50 yards to five miles. Transmitter and receiver are in the 60-lb. antenna unit. Indicator (above) has a five-inch tube. Works on 12 or 32 VDC. $1,495. Sperry Piedmont, Charlottesville, Va.

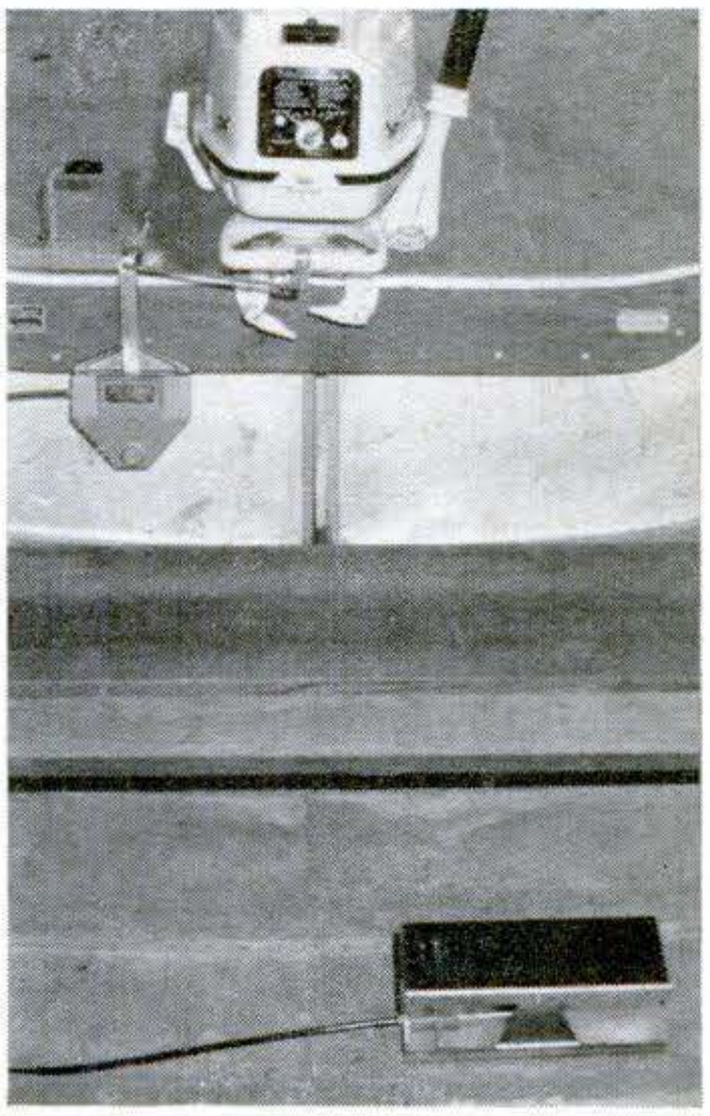


PORTABLE FISH FINDER. When sound pulses bounce off fish or the bottom, a light flashes on Fish Lo-K-Tor's dial. It indicates their depth down to 80 feet. Power comes from two six-volt dry cells. Lowrance Sales Co., Joplin, Mo.



FOOT THROTTLE. Toe pressure speeds up an outboard with Ful-Control; heel pressure slows it. Standard controls connect to pedal, which pivots in the middle. $39.50. Tempo Products, Cleveland.

PEDAL STEERING. Fishermen with a Ped-A-Tiller can maneuver while trolling, yet keep both hands free. Pedal hooks onto a cable in bottom of the boat. $19.95. Brace & Corbett, Prairie Village, Kan.



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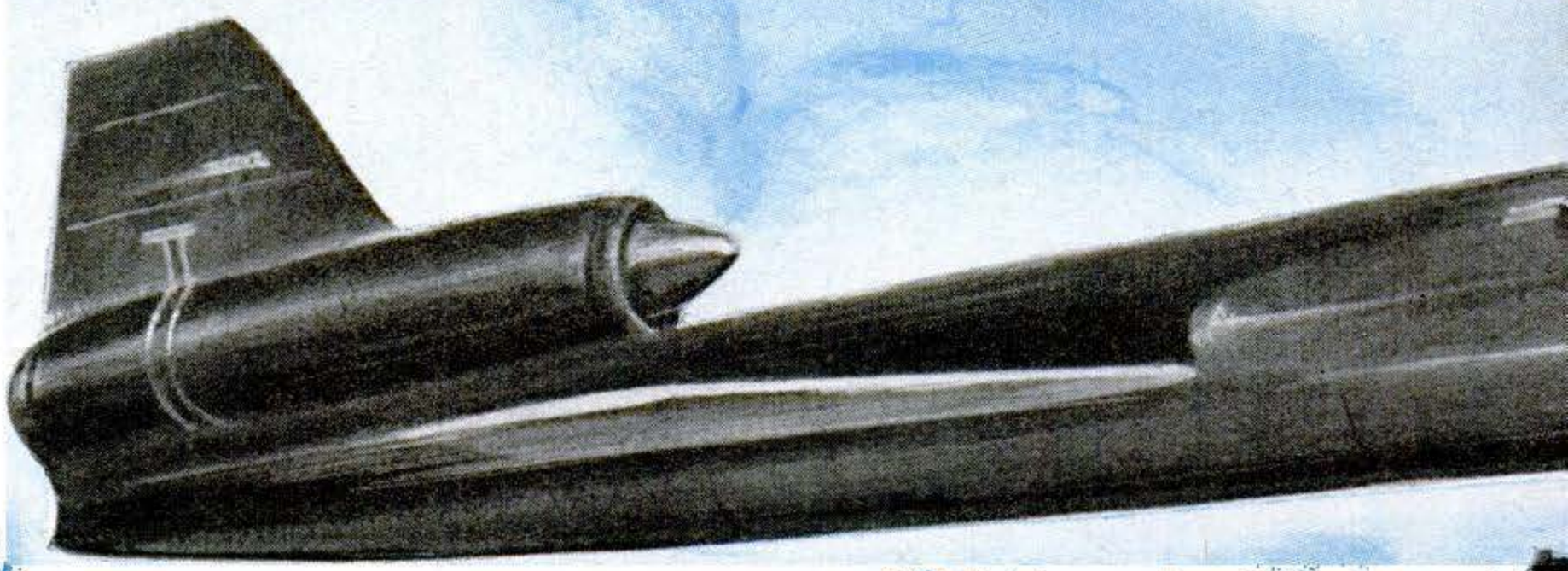
Pluto...Deadlier Than the ICBM?



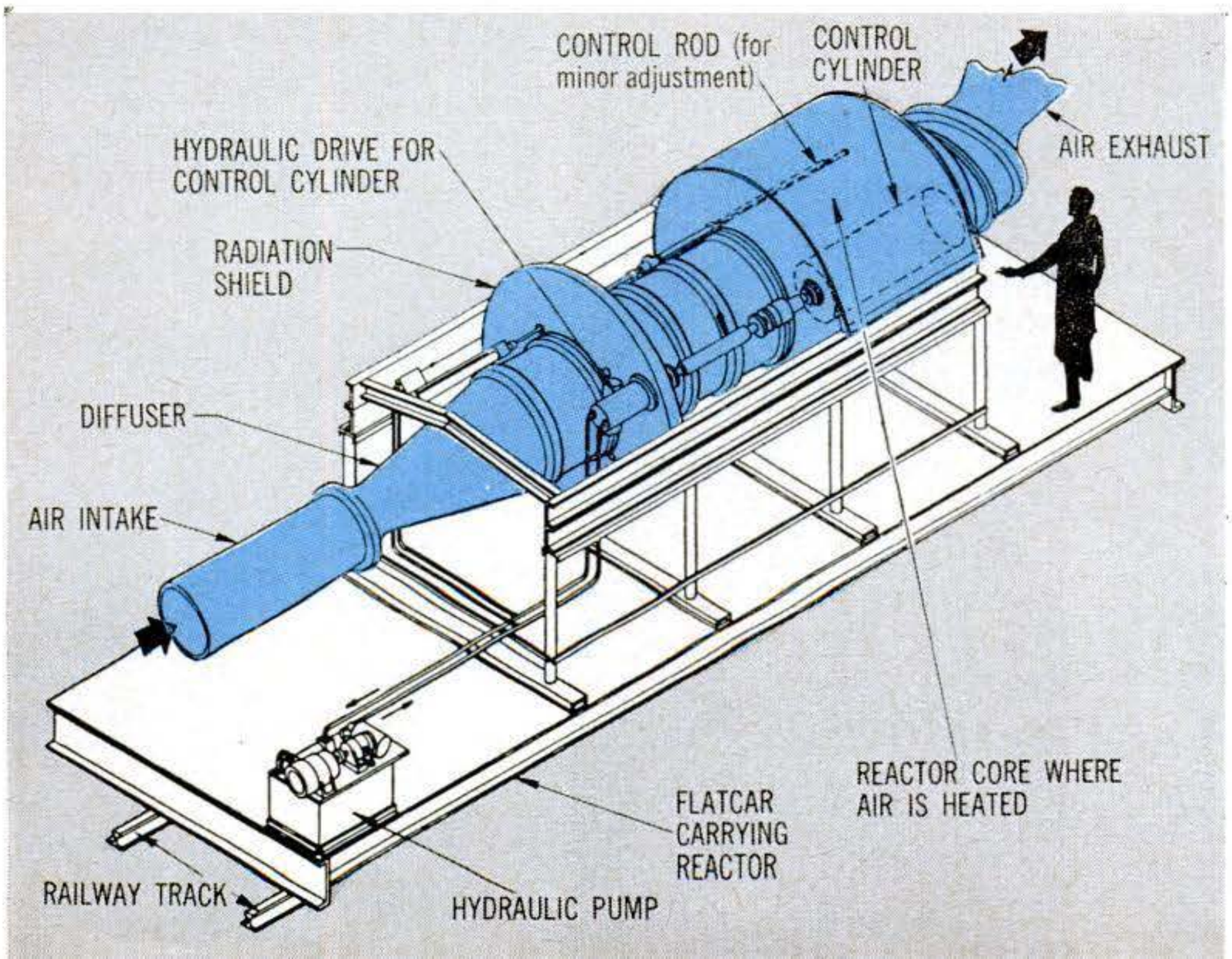
An A-powered missile, on the way for the Air Force, promises the U. S. its most formidable weapon

ALREADY the U. S. is grooming the weapon that may prove the successor to the ICBM. Its name is Pluto. An air-breathing ramjet missile of unlimited range, it will fly on atomic power. It will carry an H-bomb to any target on earth, with pinpoint accuracy, and will defy interception. It can double as a pilotless reconnaissance vehicle.

Preliminary studies have shown that the awesome weapon can be built, and now it's official that Pluto will be developed as a weapons system for the Air Force. The newly revealed AF program is called Project SLAM, short for "Supersonic Low-Altitude Missile system."

Much about Pluto is cloaked in secrecy—but facts so far released, on which our artist bases his conception of what it may look like, reveal its potency:

Its secret speed will be many times as fast as sound, requiring a cooling system for its skin. Instead of plunging out of space upon a target like a ballistic missile, it will skim the earth to its objective. Coming in "under the fence" set up by radar-warning nets, it will elude



A-engine like this one will propel Pluto

FIRST GLIMPSE of Tory II, trial version of atomic reactor for nuclear-powered ramjet missile, is given by AEC drawing showing it mounted on flatcar for test. Although a non-flying design, Tory II is called essentially a scale model of Pluto's engine. Main controls are eight rotating cylinders, of which one is shown.

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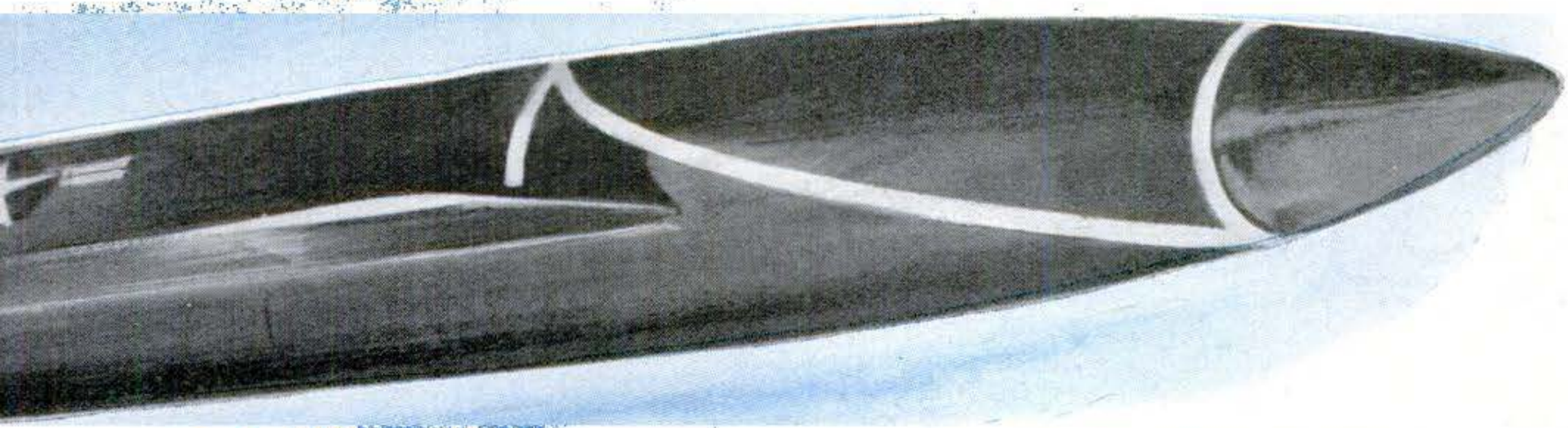
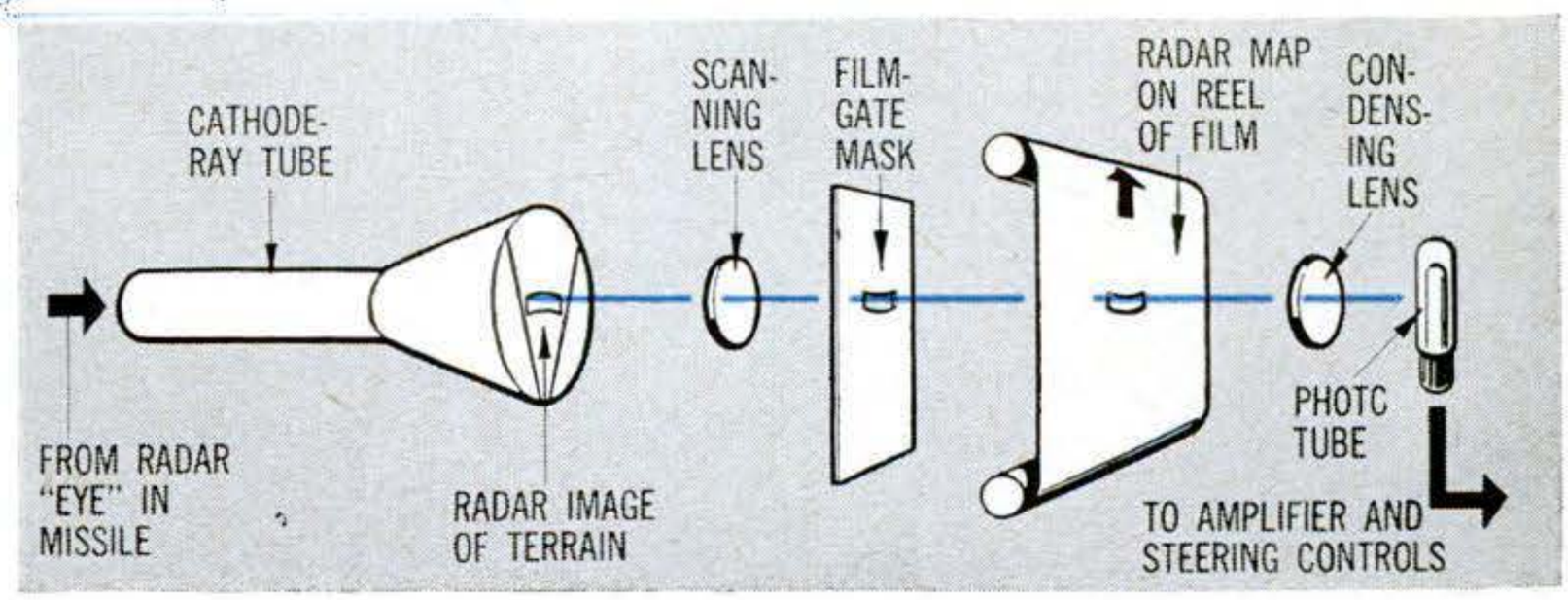


To seek out its target, Pluto will read a map



DEFYING INTERCEPTION by skimming low and fast, A-powered missile will use "map-matching" guidance as it nears objective. Air Force diagram shows principle: Missile's view of ground appears on screen of cathode-ray tube. Photo tube "sees" image through negative map of terrain on unreeling film. If missile is on course, map cancels image, and no light reaches photo tube. Misalignment transmits light, and controls alter course until registry is restored. Optical "eye" and photo map could be used, but radar and radar map are preferred.

detection until too late for interception.

Chemical-rocket boosters will launch Pluto. Then its A-engine will take over. An array of guidance systems will come successively into play—beginning with inertial guidance, and ending with the advanced map-matching system illustrated above. Probably radar maps will be used. They will serve day and night; and, if map-making flights over the territory are impossible, relief models photographed by radar technique give "synthetic" radar maps almost as good.

Preparing for the try-out. The Air Force has been conducting its Pluto study jointly with the Atomic Energy Commission, whose key part is to develop Pluto's A-engine—a reactor that must operate at thousands of degrees. For trials, a safely remote proving ground has been established in Nevada, adjoining our A-bomb test site.

Following successful small-scale experiments, an AEC team headed by Dr. Theodore C. Merkle of Livermore Laboratory is now preparing to demonstrate a sizable A-engine called Tory II. Although a non-flying version, it's said to be a scale model of the one for Pluto, and is a powerful brute itself. An output of 10,000 kilowatts of heat is only an intermediate step in bringing Tory II up to its secret "full power."

An AEC drawing now gives a glimpse of this remarkable reactor. An air intake corresponds to a flying ramjet's air scoop. Heated on the way through passages in the reactor, the air issues from a nozzle, as from a ramjet's tailpipe. Instead of control rods, Tory II's novel main controls are eight rotating cylinders of boron steel and graphite, which turn through 180 degrees to unleash or check its power rapidly.

Pluto has already proven "feasible," and progress on it is going forward "rapidly," sums up AEC Chairman John A. McCone. Adds Dr. Merkle, "I think it will put the ICBMs out of business." —*Alden P. Armagnac.*

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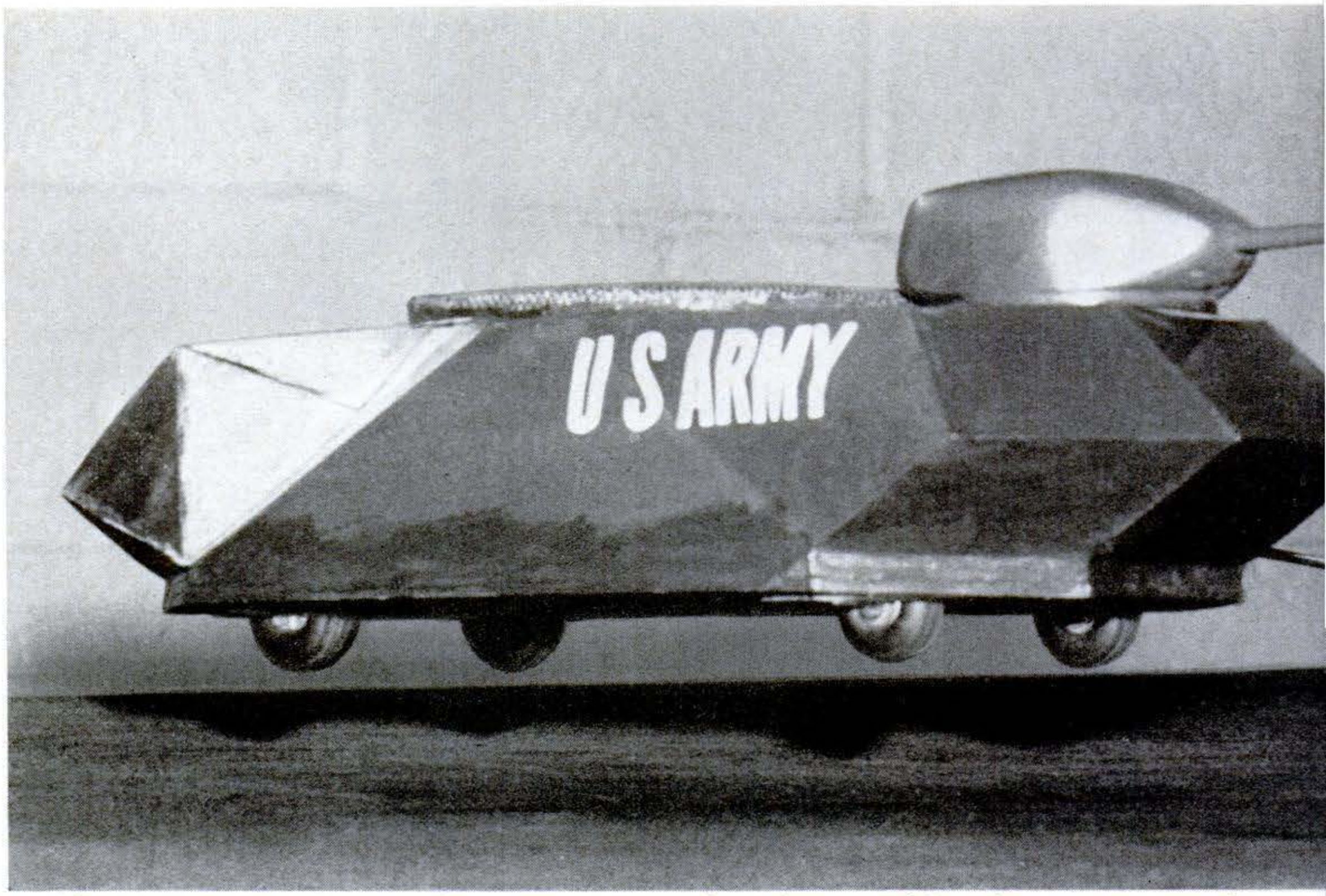

Model tank rises off table top, lifted on an air cushion from axial-flow fans. It is remotely

FUTURE TANKMEN MAY RIDE ON AIR

U. S. ground forces may soon have a tank that floats through the air. It would be based on the design of an air car developed for the Army and Marine Corps by National Research Associates and now undergoing tests. Shown at upper

TWO-STORY GARAGE. Henri Ducrocq's garage at Valenciennes, France, wasn't wide enough to take his second car. With plenty of room overhead, he built a platform lift, now raises the first car to make space for the second.

SLOT-MACHINE PRESSURE. Put a quarter in the slot, poke your arm into this gadget, and you can get your blood pressure. It registers on the dial. The device was shown at a Chicago exhibit of coin-operated vending machines.

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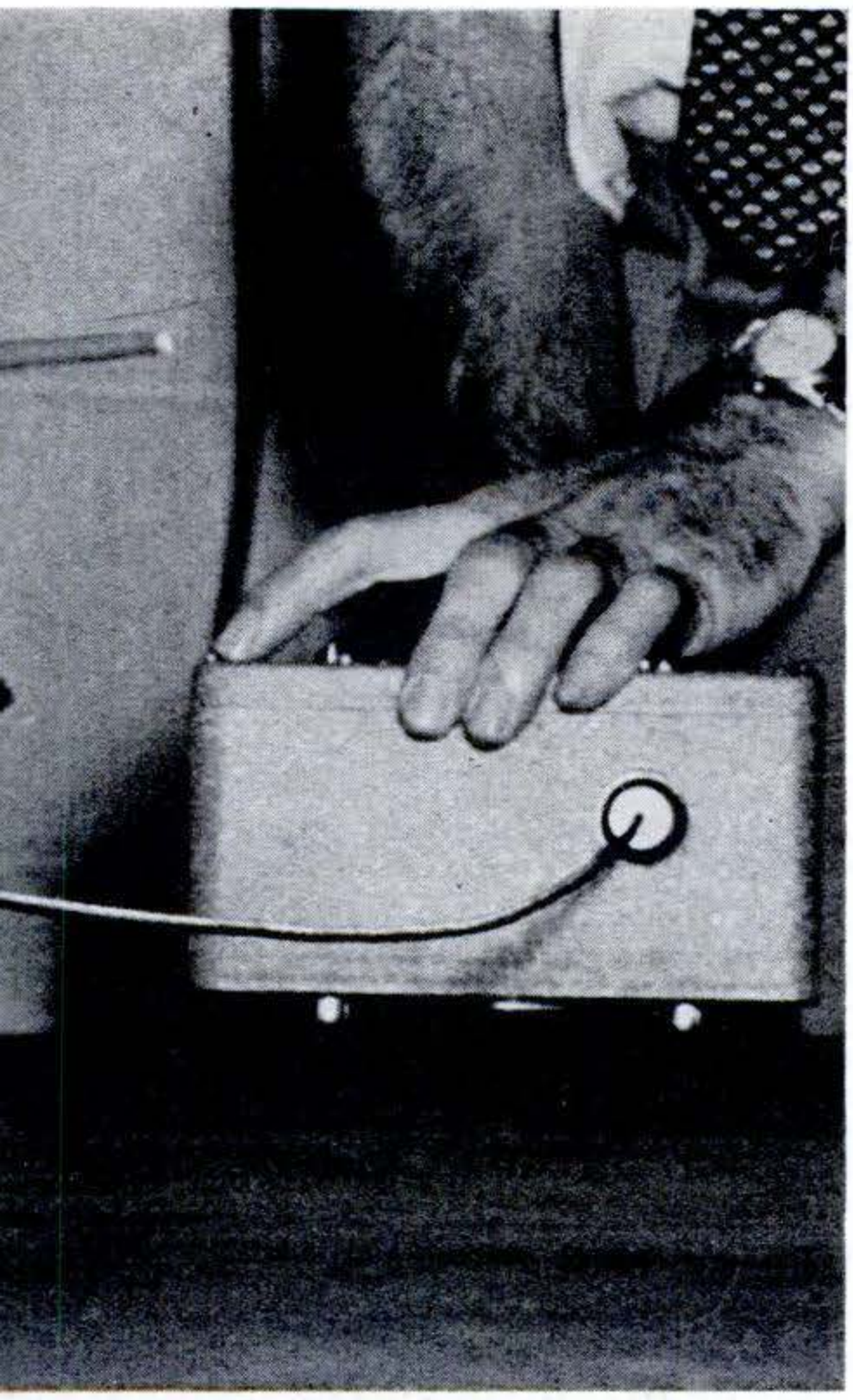
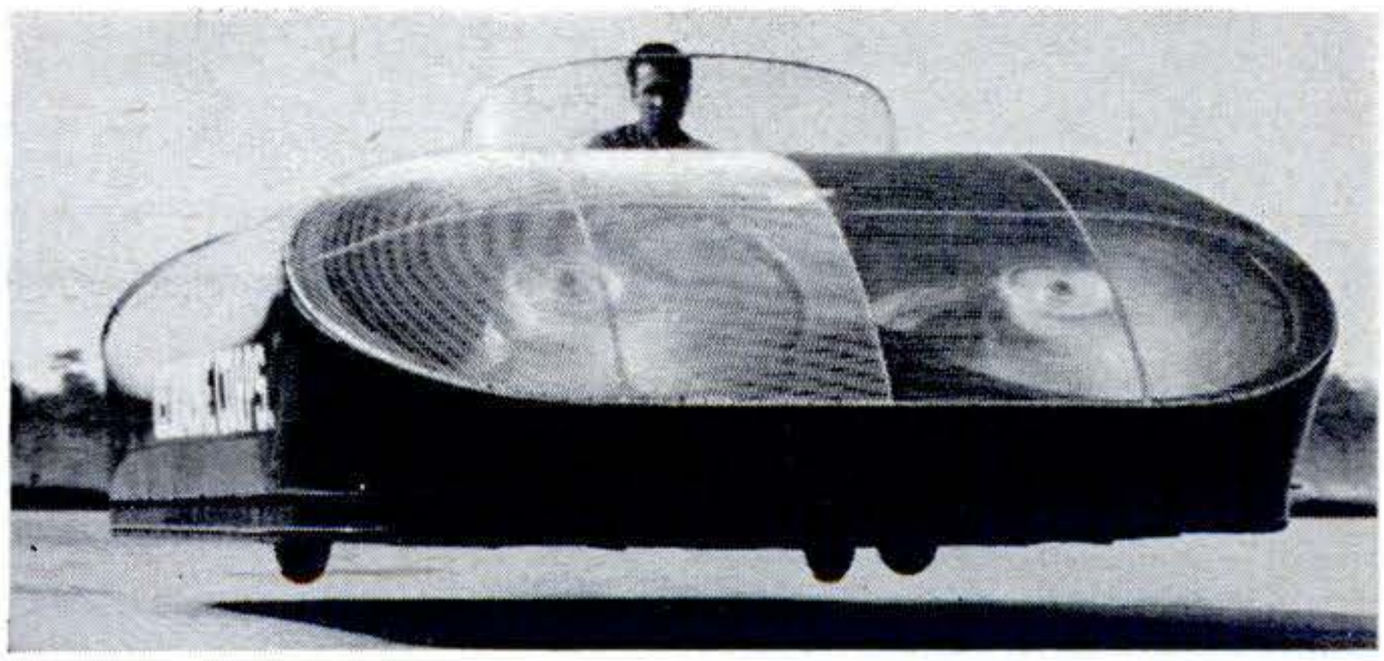
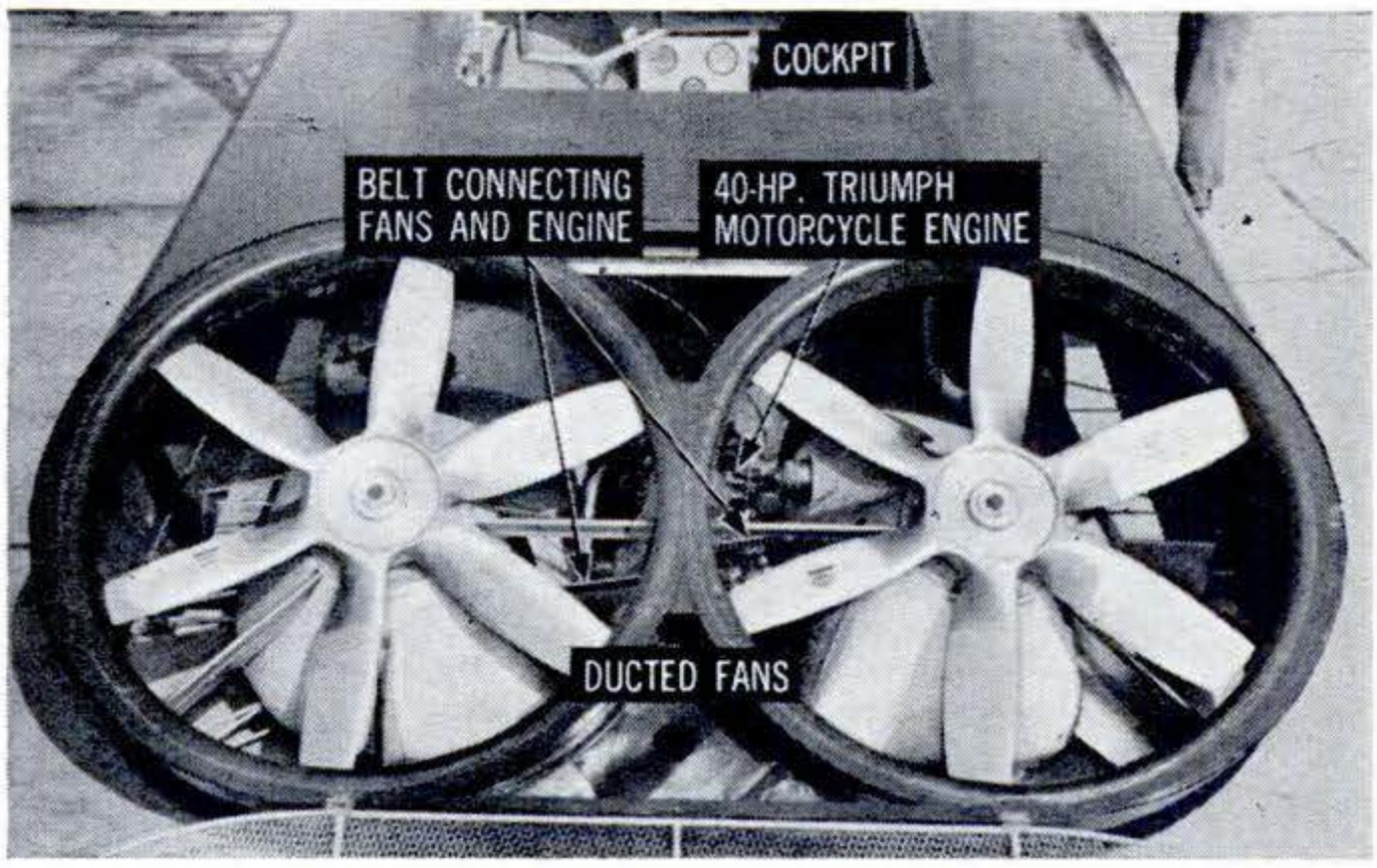


controlled from the box at right.

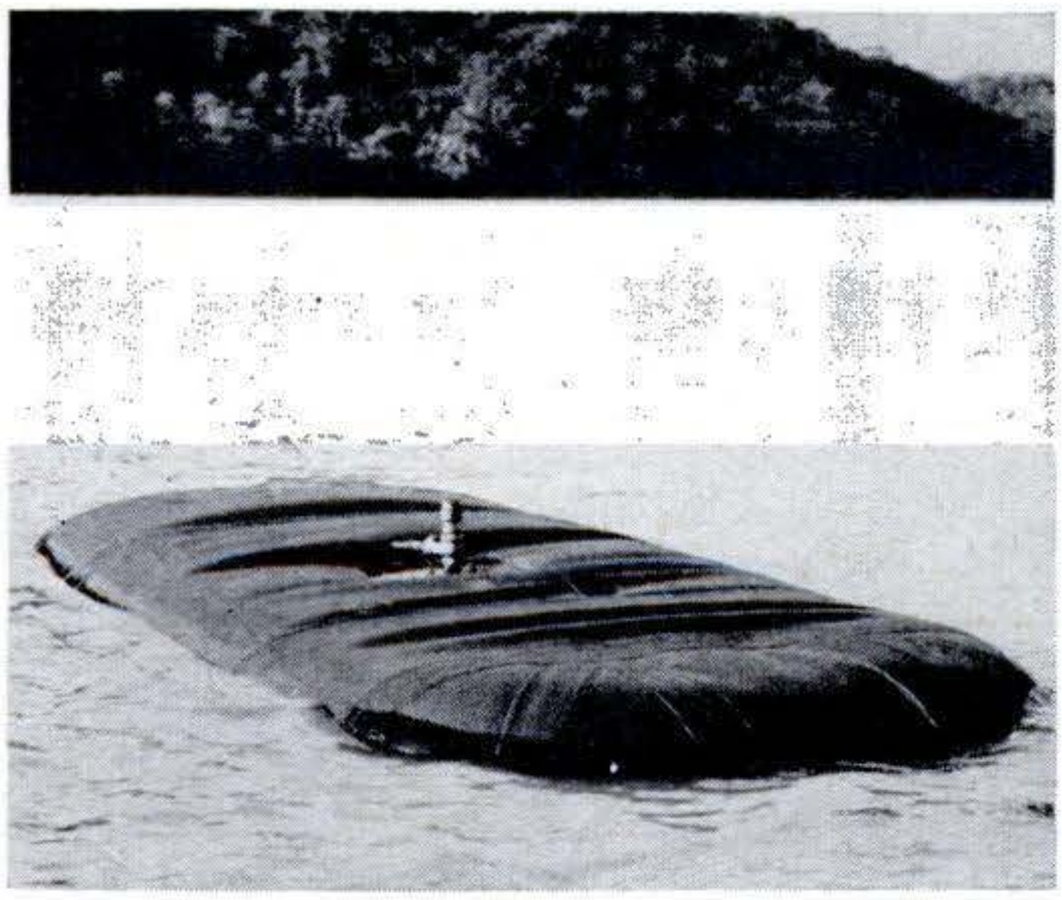


Military car is fitted with twin fans at front and back.



Each pair is driven by belt from a small motorcycle engine.

right, this car has twin ducted fans at front and rear to propel it on a cushion of air about a foot deep. Each pair of fans is driven by a 40-hp. British Triumph motorcycle engine. The tank adaptation, still in model stage (left), would lift the vehicle over rough terrain, eliminating tractor treads. The idea is said to promise heavier tanks with greater maneuverability than today's fastest.



FREE DELIVERY. Here's how gold and platinum miners in the Bolivian jungle get diesel fuel. It's floated to them downstream on the Amazon in rubberized nylon tanks originally made for storage. When emptied, they return by plane.

CARTNAPPER THWARTER. A couple of Detroit inventors came up with this idea to keep customers from taking supermarket carts home. Locks are built into the wheels. They are set by magnets buried in the ground around the store.

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Village Blacksmith Makes House Calls

By E. F. Lindsley

ANYONE who thinks the village blacksmith shop has gone the way of the buggy-whip factory has only to visit the Roeker boys in their shop near Walworth, Wis. Here, Victor and his two sons, Everett and William, carry on a third-generation tradition.

It's more than a tradition. It's a thriving business, too. You won't find it in the center of town. It's down the road a piece out on the Roeker farm. There are no signs to guide you; the Roekers don't need any. Anyone within miles can tell you how to get there.

The only thing that's changed in half a century is one way of doing business. In the old days, horses came to the shop. Today, Vic can get to the horses much faster than they can get to him, so he makes house calls.

HE'S put his shop on wheels. In a panel truck fitted out as a mobile smithy, the Roekers travel as far as 50 miles to minister to ailing hoofs. Customers often tell Vic nothing more than a horse's weight; others send in a rough sketch of the hoof shape. Yet Vic, who started out by shoeing his own pony at the age of six, knows that the shoes will fit when he delivers them. Minor adjustments are made at the scene on the portable Roeker anvil.

Horseshoes, however, are only part of the job. Many other delicate, loving, painstaking tasks are performed on an ancient forge in the old iron-littered, smoke-blackened shop. One day it may be a special part for a boat trailer, another repairing a farm wagon, still another welding a kid's bicycle or basketball hoop.

PLOWSHARES are big business. Much time is spent whacking them back into shape. Here forge welding, drop forging, and heat treating are all in a day's work. Dozens of plows are stacked and scattered about the shop, each one calling for a personal bit of attention.

Some of the plows have been cracked and split by rocks in the Wisconsin glacial soil. These Vic rebuilds, usually by forge-welding a reinforcing plate over the damaged area, neatly blending and shaping the metal to the exact contours needed for the particular soil of some farm he knows well. It is Vic's extensive knowledge of local conditions that enables him to do custom work, as different soils often require different shapes of plows.

FORGE welding is no easy art. Nearly anyone with a steady hand can master an electric-arc or gas torch. Forge welding, however, starts with building a fire in the forge, using the proper coal, holding the blower to just the right draft, then observing the metal and ap-

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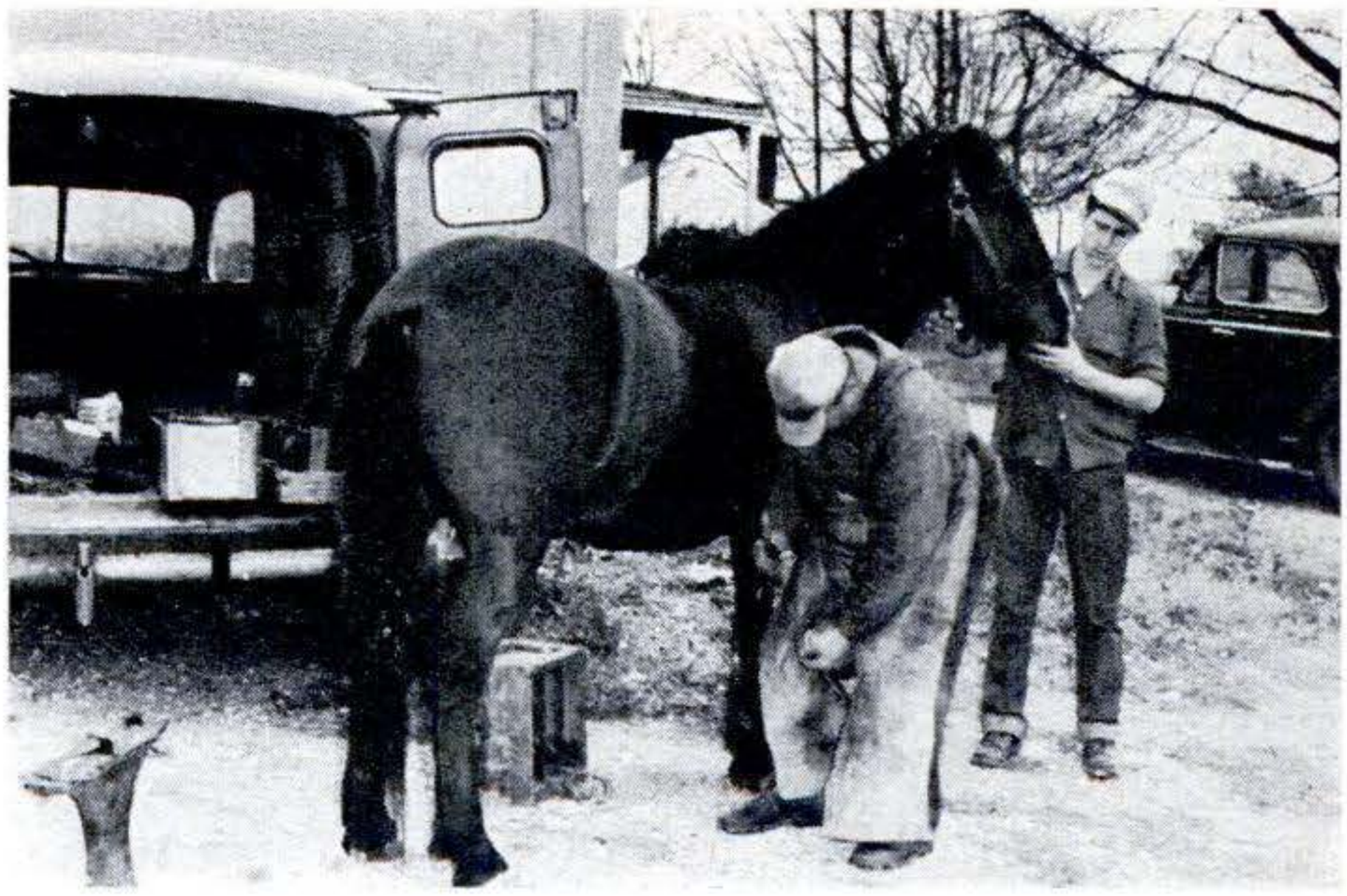
Traveling to the job is one of the few concessions Vic Roeker makes to modern times. Here, with their panel truck fitted out as a shop, Vic and his son Bill visit a horse that stands patiently for a retread.



plying the flux so that finally, when heat and color tell the experienced eye that all is ready, the patch can be applied and hammered home solidly.

No scale or voids can separate the fused pieces: A good forge weld is a true marriage of metals. Not many men can make such a weld today. The Roekers have learned to treat iron and steel like a good horse: You don't flog it; you caress it.

As old as his art is, Vic is not one to shy away from modern equipment. One of his furnaces is fed by butane gas and is shaped like a long, narrow feed trough. It can handle two plows at a time.

Once started, the furnace rumbles and roars, sending flames dancing along the edges and illuminating the smudge-dark corners of the old building where shoes of long-forgotten horses cluster on overhead beams. With loving care, Vic adjusts the exposure of each plow blade to the flame, nudging and tugging gently with his tongs.

When the steel glows to just the right color, Vic swings it quickly to the power trip hammer he uses to shape and reform the blunted edge. Watching him, you see the poetry of an artisan at work. Delicately controlling the hammer speed with his foot, he guides and turns the piece under the rapid strikes of the hammer so that the glowing metal creeps and flows as if magically knowing its master's mind.

As the metal darkens, the blows grow lighter, fining out the edge, straightening a slight ripple, putting a point on the tip.

Then the hammer becomes quiet, and Vic turns the blade in his tongs, sighting and squinting along its back and edge. If he's satisfied, the blade is ready for heat-treating, grinding, the finishing touches.

BLACKSMITHS are designers, too. A farmer will pull up in a chicken-scattering flurry of dust. He needs some anchor brackets for a new barn foundation, he explains hastily. He isn't quite sure of the exact shape, but they ought to have a slight bend down at the sill line.

Quietly, like his father, Everett Roeker plunges a husky length of strap into the old coal forge.

After 30 minutes at the anvil and drill press, the anchors are formed. Cutting, bending, and drilling are all done by eye. The shape is pure invention of the Roeker imagination. Yet the anchors are perfect.

Bill Roeker, youngest member of the talented clan, shod his first horse at the age of 11 and is already a first-rate blacksmith. From father to son—and on to future sons—the Roekers know that their work will be there for as many years as they care to follow it. For there's just no getting along without the village smithy.

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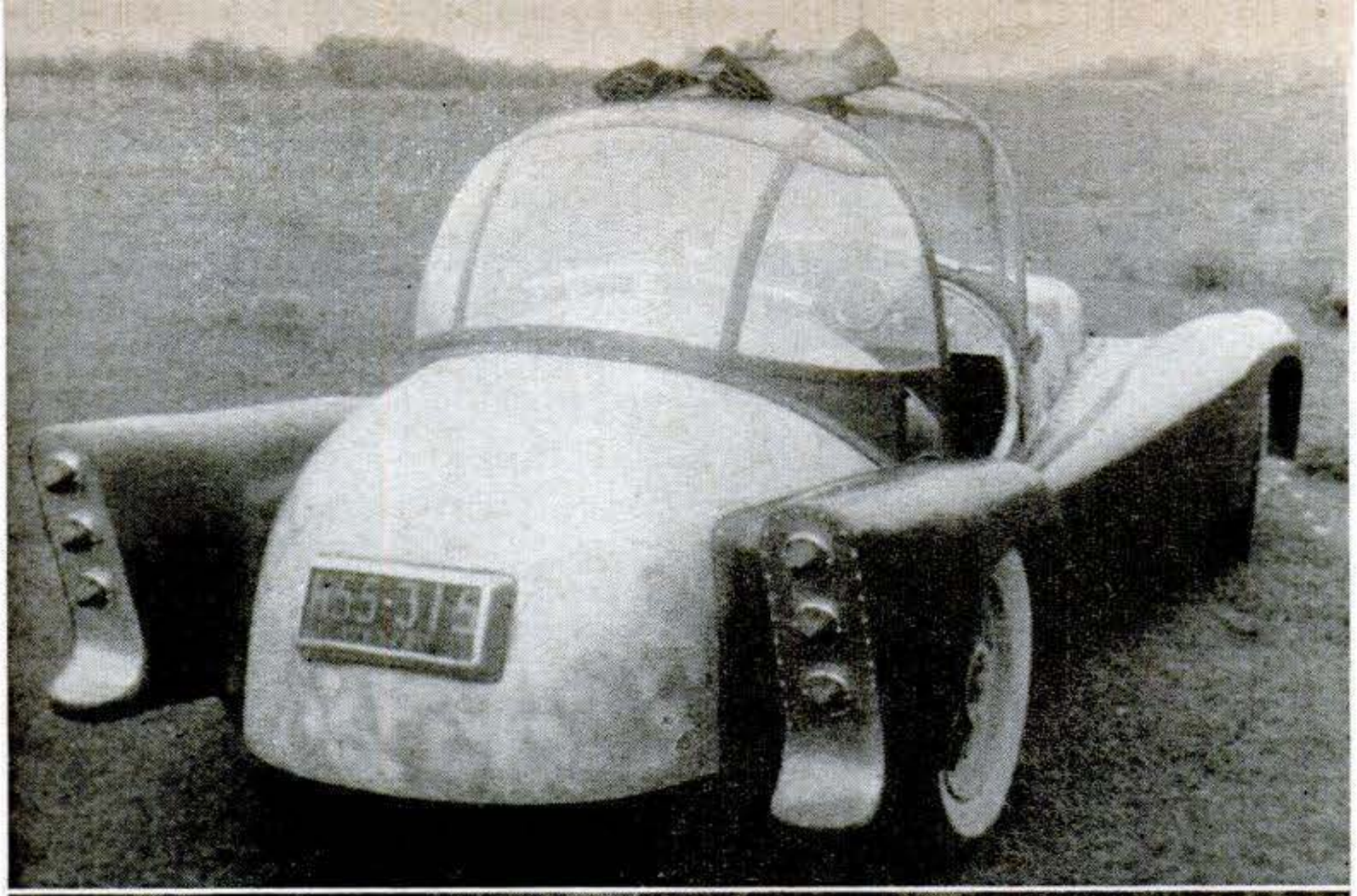


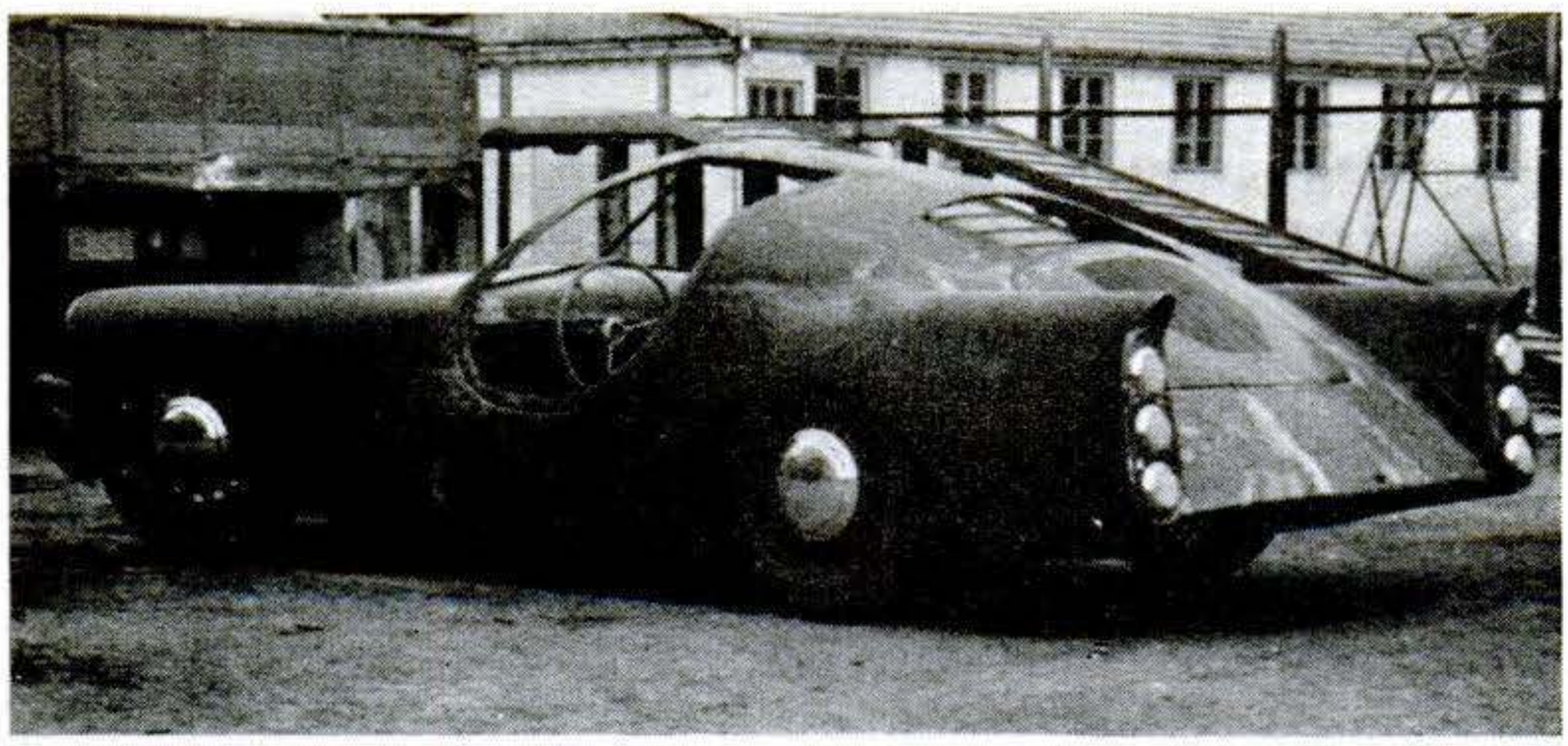
Hand-hammered to shape by an energetic back-yard mechanic in Przemysl, Poland, the body panels of this car are riveted together. Triple tail-light clusters are built into the fenders, and sporty wire wheels with whitewall tires enhance the roadster's rakish lines. Roll-up curtains close the plastic canopy. Motive power is an old 67 cubic-inch Skoda engine.

Car-Hungry Poles Build 'Em from Junk

ON THE far side of the Iron Curtain, the smell and glitter of brand-new cars in auto showrooms is almost wholly unknown. Even there, however, mechanically minded young men have shown themselves willing to trade ingenuity and hard work for the dreamy joys of actually owning a car.

Pickings are poor in Polish junkyards; little is thrown away until it reaches the absolute end of the road. Blacksmithed chassis parts and hand-hammered sheet metal are often necessary. Finding a repairable motor and transmission is usually the hardest job of all.

Many of these labors of love produce strange-looking vehicles. Frequently they show the influence of American car design. Shown here are some of the finalists in a recent contest to find the best home-made machine. Sponsored by a Polish magazine, it attracted some 180 entries.



Sports car will have gull-wing doors hinged at the roof when it's ready to roll. It's basically a 20-year-old Volkswagen with suspension altered to lower the body. Power was boosted by increasing cylinder bore and compression ratio, installing twin carbs. Weight: 1,200 pounds.

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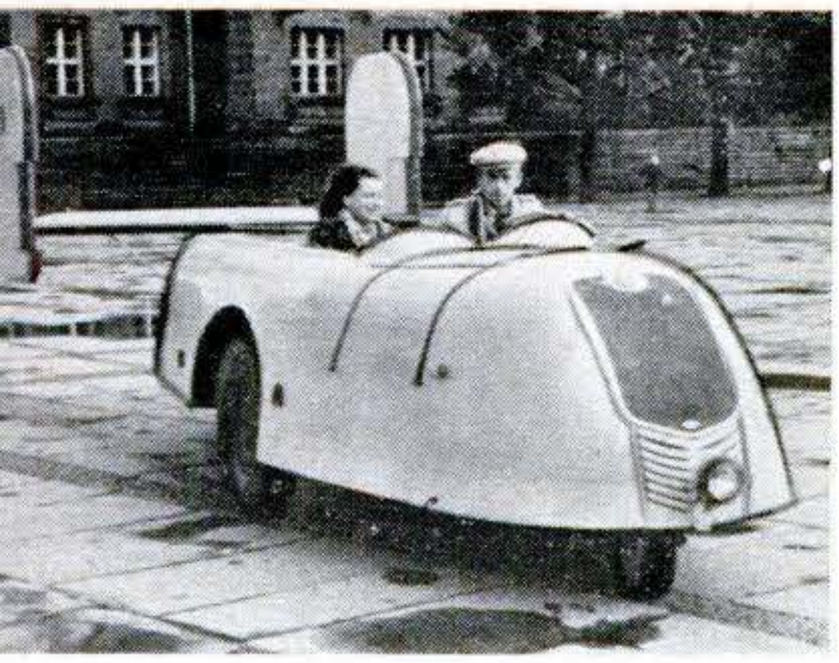
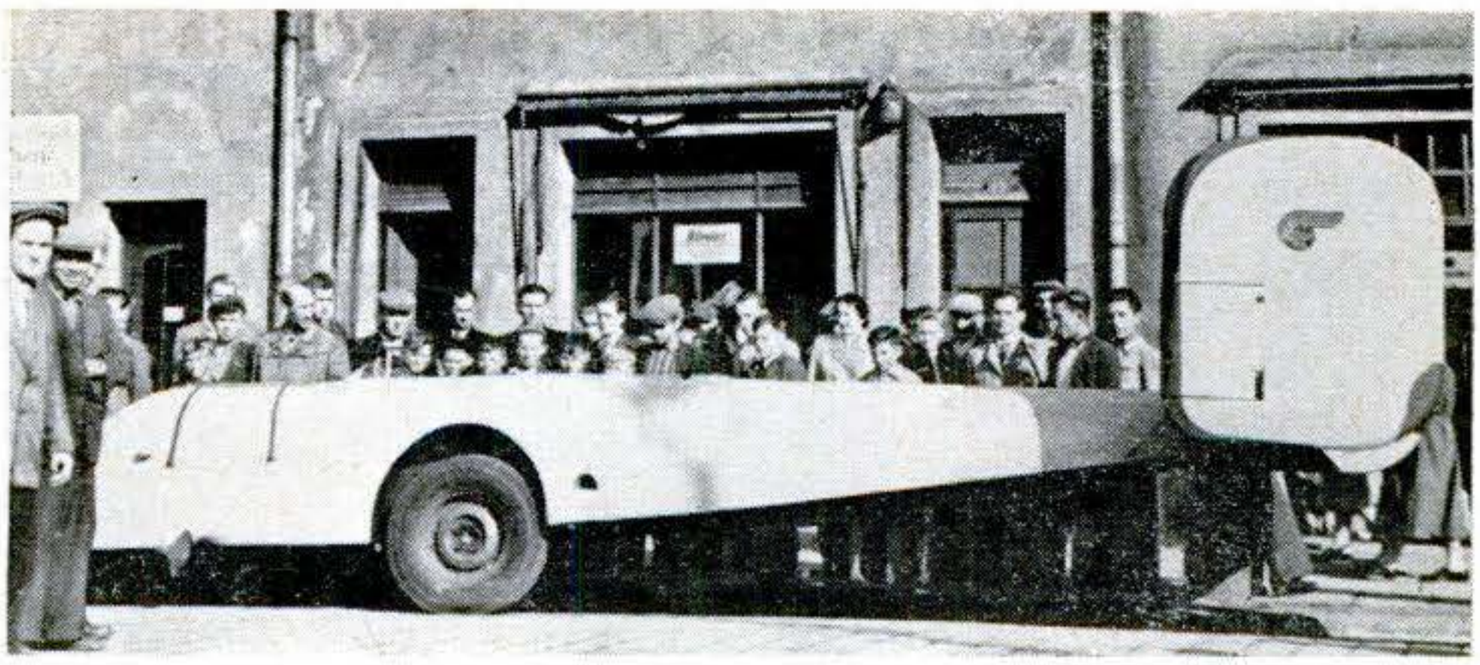
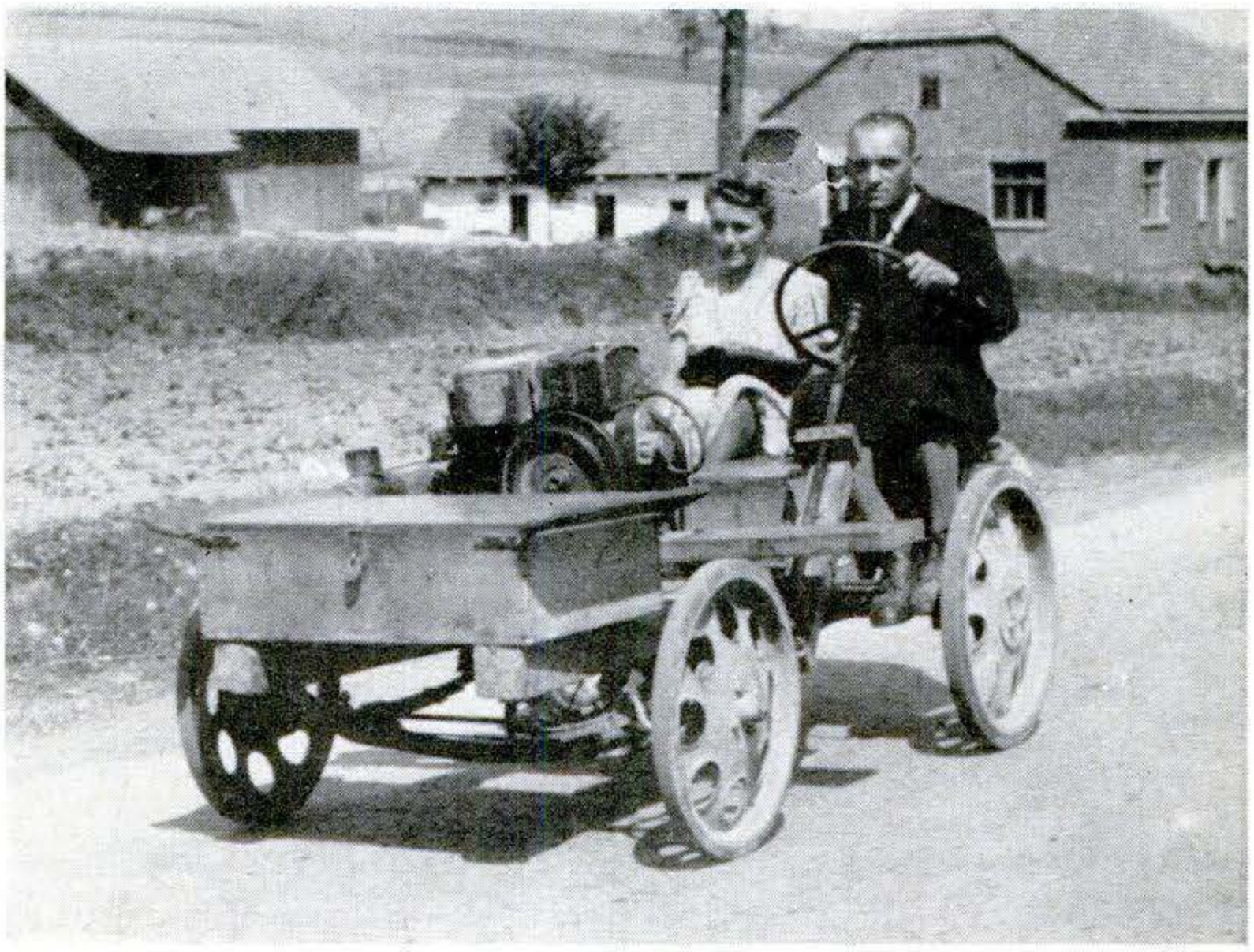




Outfinning all Detroit, this three-wheeler from Poznan has a massive tailplane that lifts the nose wheel off the road at speeds above 40 m.p.h. The car then scoots on its two drive wheels, steered only by the dual rudders. An old 103-hp. Mercury V-8 powers the 23-foot, 1,600-lb. aerocar. Top speed is said to be 100 m.p.h.



Better than walking, this contraption built by a Polish farmer has a wooden frame, springs and axles from an old Austin, and steel cart wheels with solid-rubber tires. A one-lung engine from a cement mixer rolls it 58 miles on a gallon. Power is delivered to the rear wheels through two gearboxes linked to a belt drive.

Expertly cobbled from junked parts, this trim three-wheeler carries its builder and his brood of three at 18 m.p.h. He used the wheels and front fork of a motorcycle, bicycle handlebars, and a tiny six-cubic-inch engine from an old scooter.

Got a horse but no engine? A taxi driver in Nowe Miasto ripped the defunct V-8 out of this 1936 Ford, built a seat on the engine compartment, and hitched on an oat burner, which is easier to come by in Poland than engine parts.

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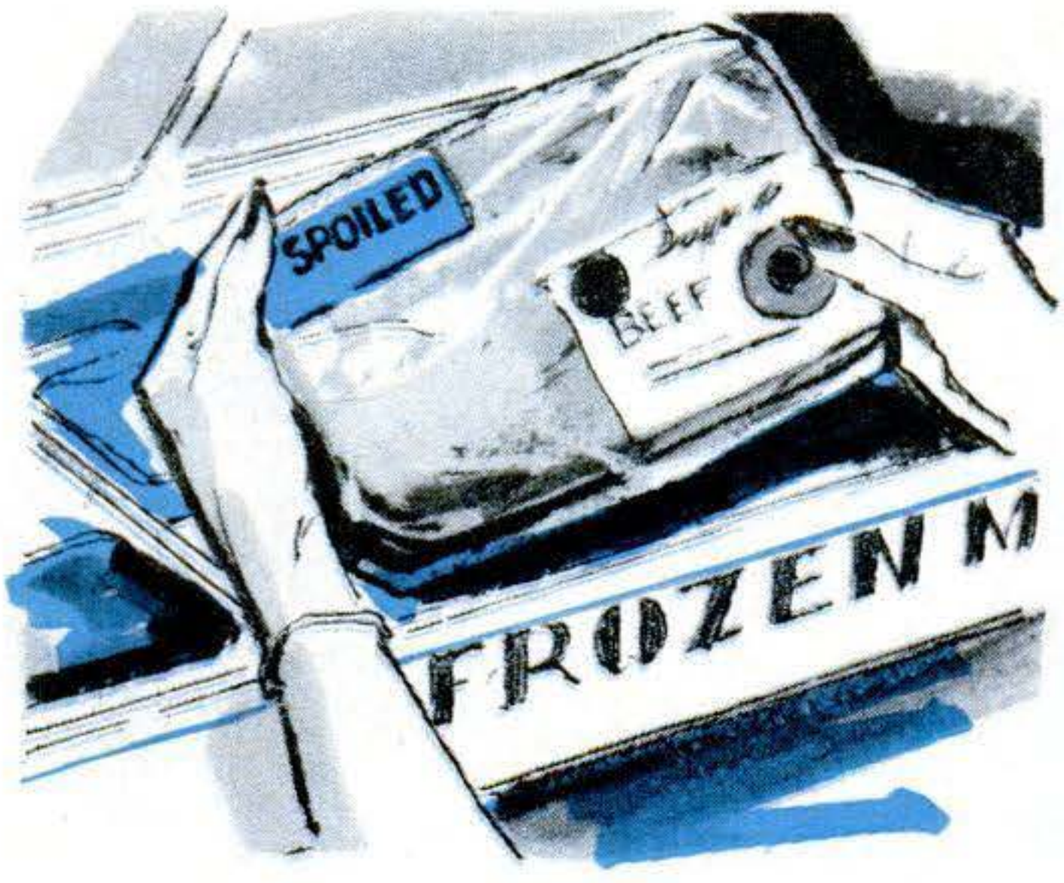
New Ideas from the Inventors

Trunk Deck Raises Luggage. Instead of lifting heavy grips or cartons out of this trunk, recently patented by GM, you'd just slide them off the fender-level platform. Platform and deck lid, built as a unit, would be power-lifted as shown. The trunk's space would be as accessible from the sides as from the rear.

Fluid Joint Improves Rifle's Aim. By damping barrel vibration that results from shooting, an oil-filled cylinder between barrel and stock of this rifle might keep the rifle accurate for a longer time. Vibration, says the inventor, loosens conventional wood-to-metal mountings.

Telltale Label Guards Food. This frozen-food protector would let you know if the contents of a package had been accidentally thawed and refrozen. Any temperature rise great enough to spoil the food would also melt a wax coating and reveal a printed warning beneath.



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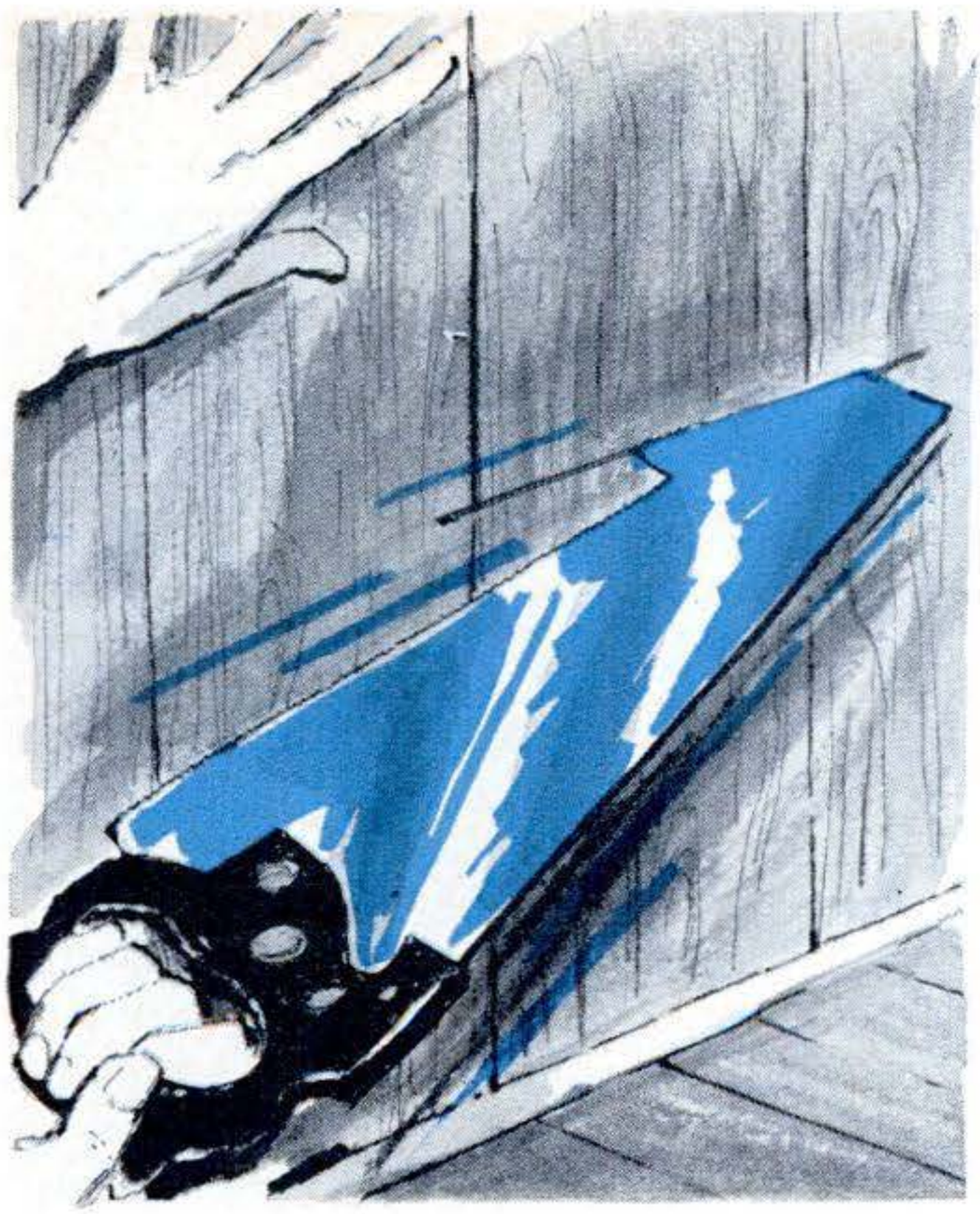
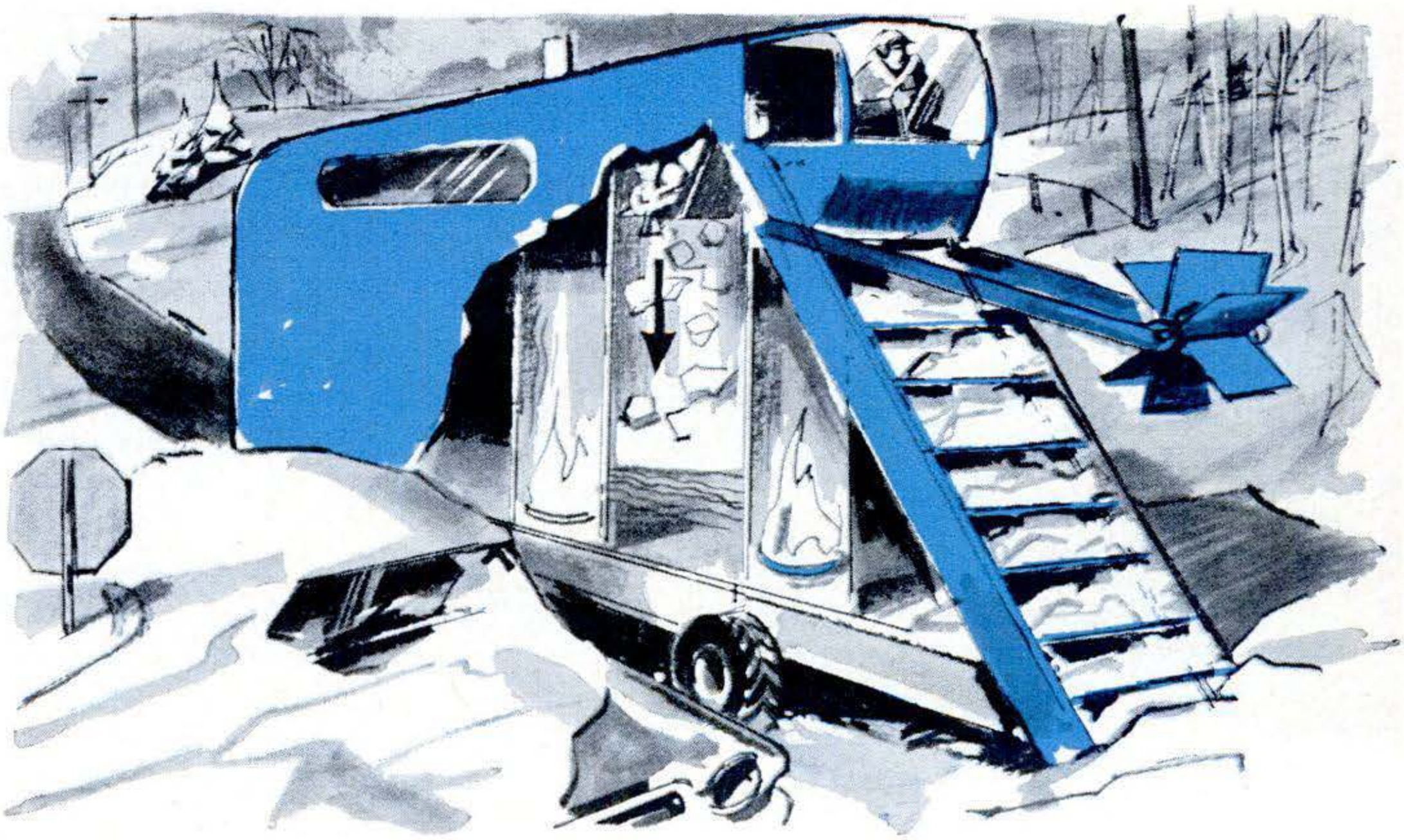


Stepped Saw Starts Blind Cut. You wouldn't have to drill a panel to start an inside cut if your saw had this toothed offset. Stiffened by the larger blade, it would cut straighter than a keyhole saw. And—once the cut was started—the offset could act as a stop for the regular saw.

Cap Monitors Brake Fluid. Designed to replace the regular filler cap of a master brake cylinder, this signal device would warn you if hydraulic fluid fell below a safe level. A float in the cap would operate a switch that could be wired to a buzzer, light, or other alarm.

Heated Tanks Melt Plowed Snow. Snow can be compacted to about a tenth of its original volume by melting it down. This inventor would scoop it into heated tanks. Collected water would either be discharged into sewers or sprinkled over plowed banks to speed freezing, keep drifts from blowing back onto the road.



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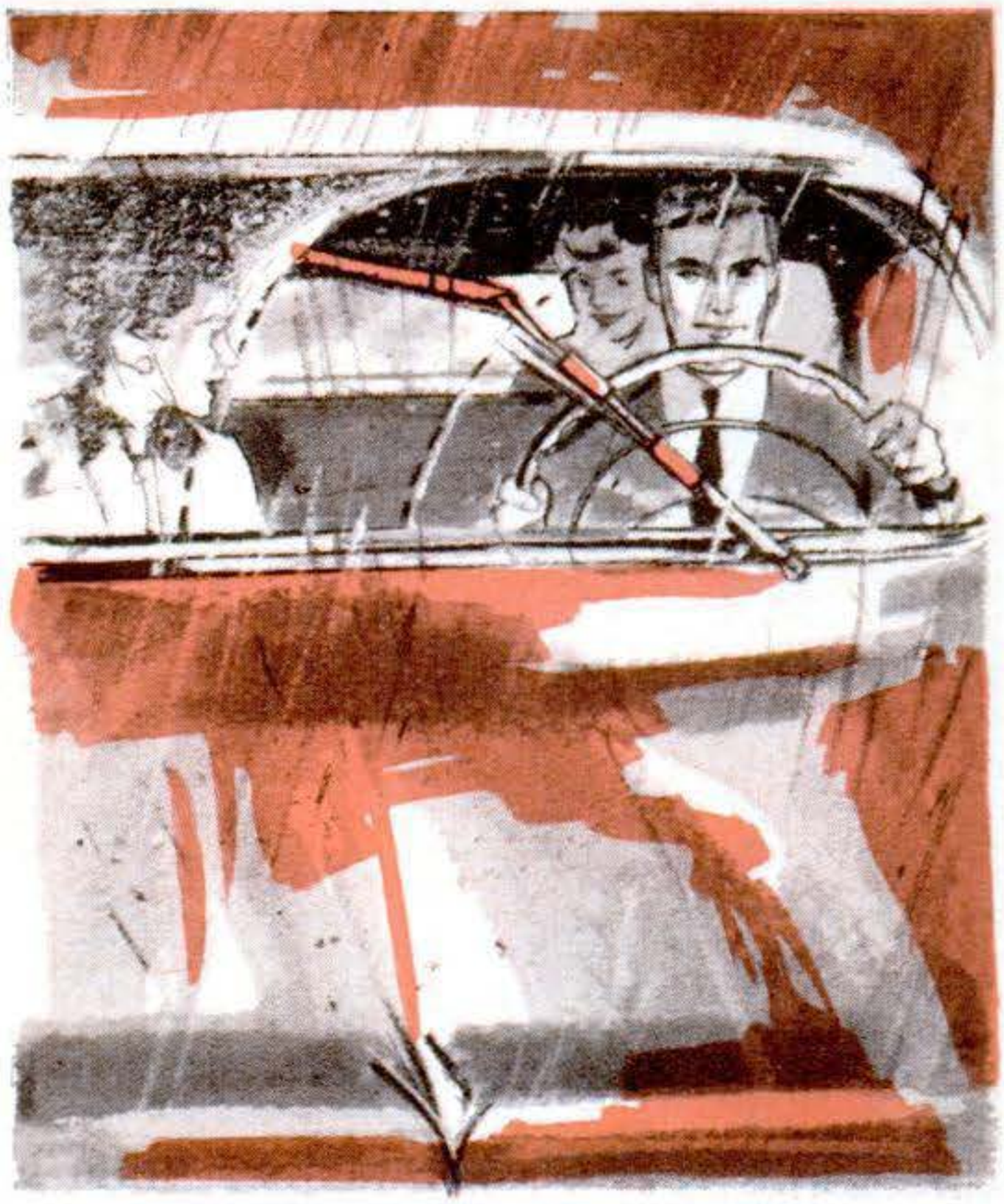
More Inventors' Ideas



Wiper Clip-on Widens Arc. Extending at an angle from the regular wiper, this attachment would sweep an irregular arc. It would reach the common blind spot at the upper center of a windshield, then bend (on the return stroke) to accommodate to the tighter spaces at the sides.

Lighted Post Ends Disc Fumbles. With this illuminated spindle, loading discs on a turntable or automatic record changer would be quicker and easier. Made of plastic, the post would enclose a small bulb that would double as a pilot light. Eliminating fumbles would also protect the record centers against chipping.

Gutter Hides Behind Shingle. Conventional gutters, says this inventor, are noted for their "lack of ornamental qualities." To remedy that, he'd form the trough into a narrow wedge conforming to roof lines. A wooden face crimped to the metal could be painted or shingled.

The following patents have been issued on these inventions: **Trunk lift**—*No. 2,890,908 to R. McLean, Oak Park, and G. Podolan, St. Clair Shores, Mich.;* **Rifle**—*No. 2,894,347 to F. Woodcock, Gloucester, England;* **Label**—*No. 2,782,749 to J. Beckett, Glendale, and W. Marenus, Burbank, Cal.;* **Saw**—*No. 2,780,256 to J. Dodd, Temple City, Cal.;* **Brake signal**—*No. 2,786,110 to A. Bitle, Richmond, Cal.;* **Snow melter**—*No. 2,738,786 to E. Leary, San Francisco;* **Wiper clip-on**—*No. 2,787,018 to S. Smith, Chicago;* **Lighted post**—*No. 2,788,437 to E. Howle, Charleston, S.C.;* **Gutter**—*No. 2,780,184 to F. Olsson, Floral Park, N.Y.*

Copies of patents may be ordered, by number, from the Commissioner of Patents, Washington 25, D.C., at 25 cents each. To write to an inventor, if the address given above is insufficient, you may address him (by name and patent number) in care of the Commissioner of Patents.

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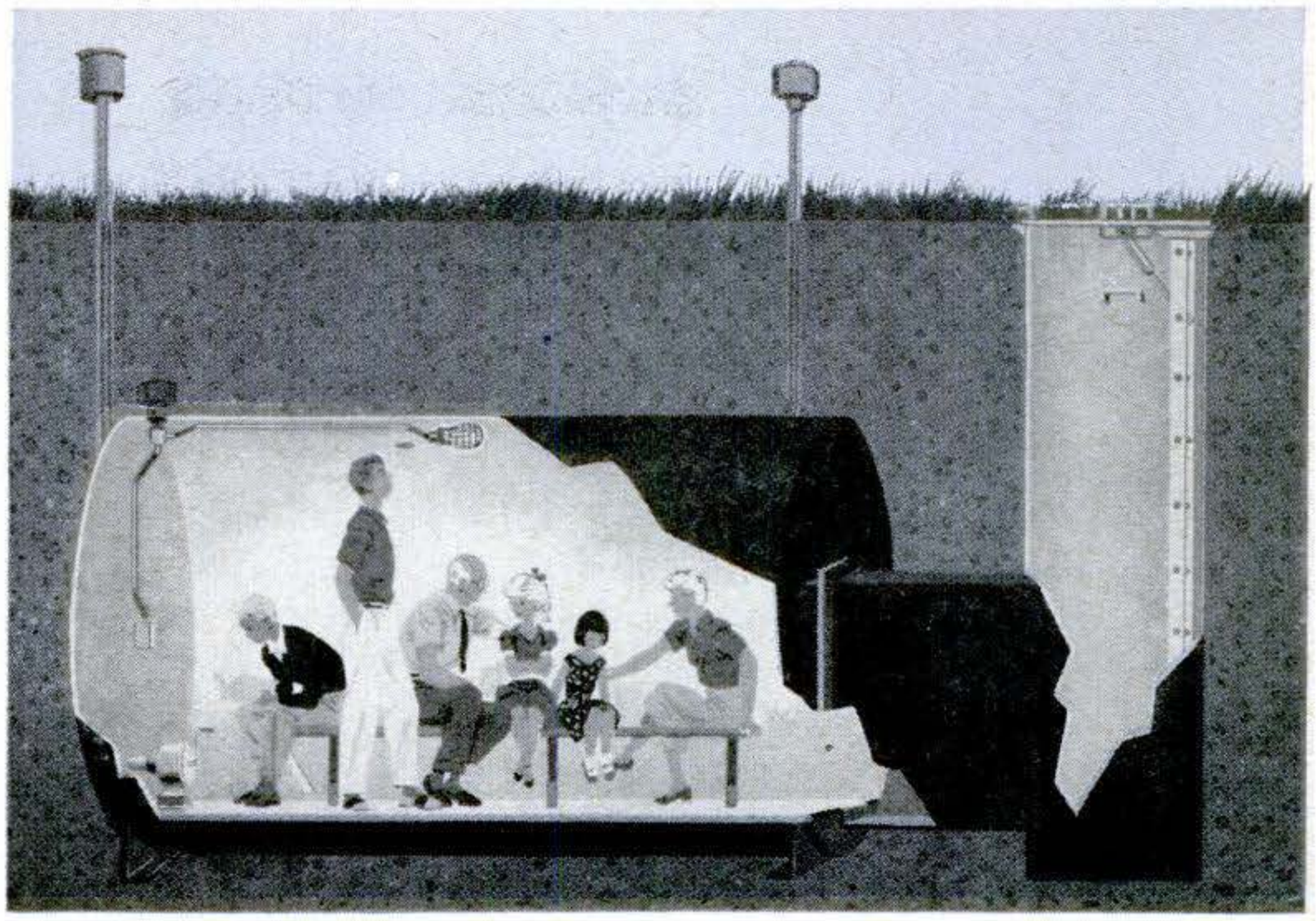
SHELTER PROTECTS AGAINST FALLOUT

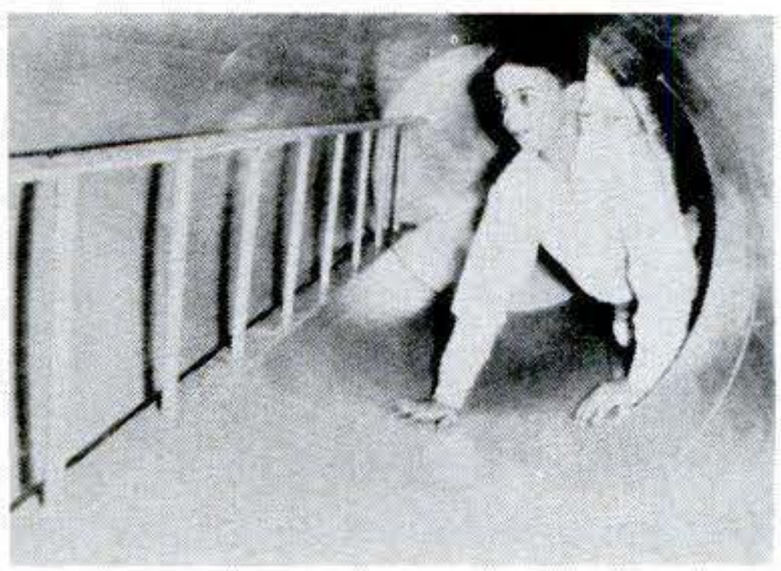
A nuclear-bomb shelter that will accommodate a family of six comfortably is being made for civilian use.

It's a steel tank buried three feet under the ground. Entrance and exit are through a submarine-type airlock and a ladder in a vertical tunnel. The near photo at right shows a boy passing through the crossover to the entrance with the tube on its side before installation.

Above ground are a filtered air intake and an exhaust duct. The shelter is made by Koven Fabricators, Inc., of Dover, N. J.



Family survival shelter has living quarters of normal room height.



Entrance is equipped with ladder. Hammocks supplement two bunks.

FOR FISH-EYE VIEW. When the drums on this device are filled, it submerges so University of Wisconsin students can study the feeding and spawning habits of bass. It's mounted on an 18-foot barge, propelled by outboard motor.

What's He Carrying?

Turn the page to see ▶

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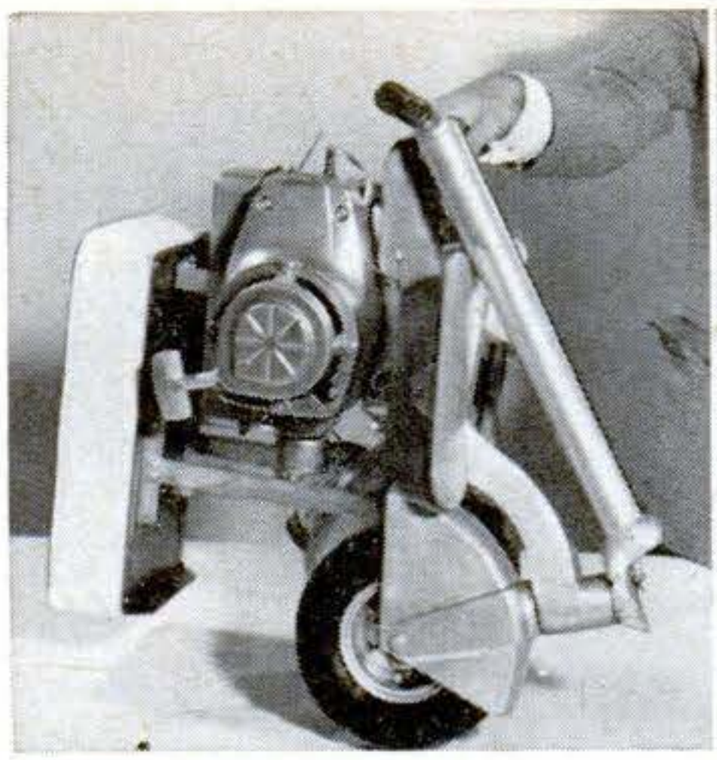

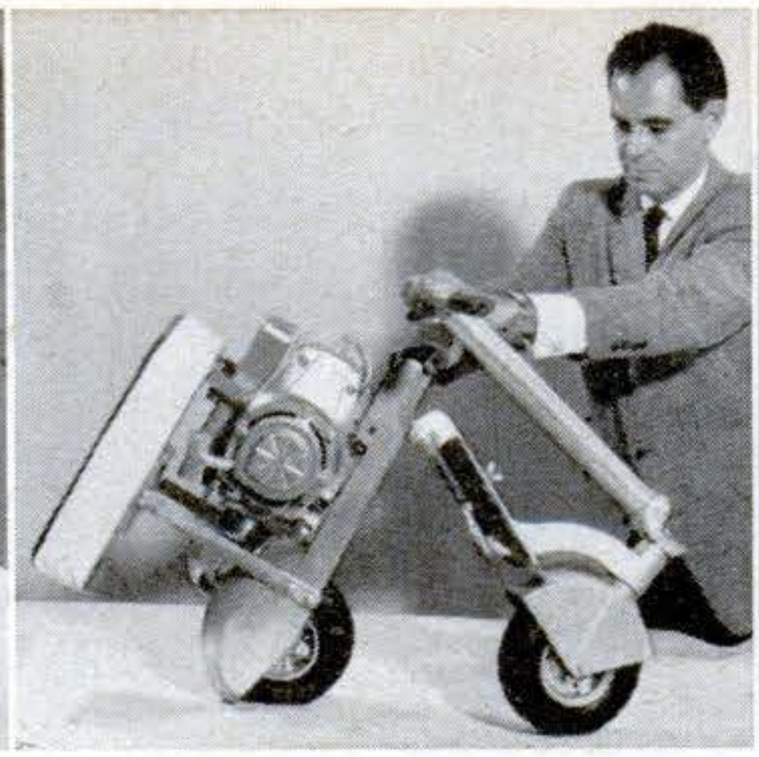

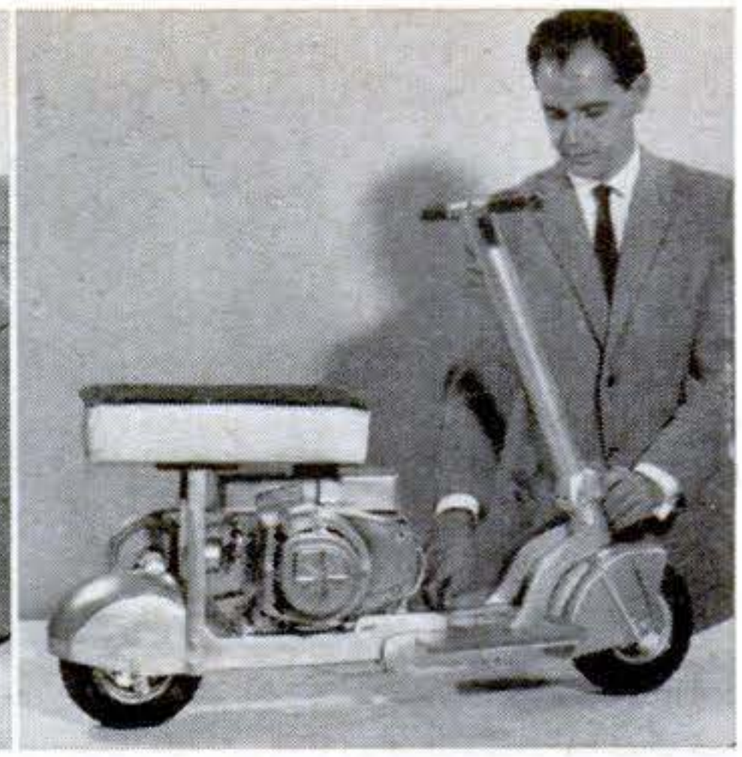

HINGED IN TWO PLACES, the scooter is flipped open by pulling out the steering post and pushing down on the middle part of the frame. Two wingnuts (one at each hinge point) are tightened to lock the scooter in riding form. It takes about 15 seconds to make the conversion.

40-M.P.H. Scooter Folds into a 51-Pound Package

THE JoyRide scooter can be carried or stowed in a car trunk, boat, plane, checkroom, or closet. Aluminum castings for the combination frame and body hold its weight down to 51 pounds. And most of the weight is in the two-cycle 2¼-hp. Power Products engine.

The four-ply pneumatic tires measure 2.50-by-4. A pull cord operates the recoil starter. Transmission, through a V belt and pulleys, is automatic. The throttle can be rigged for foot or hand control; the single (rear) brake is pedal operated. One tiny tankful of gasoline—with oil mixed in—takes the scooter 40 miles. It goes 100 miles on a gallon.

JoyRide is available at some department stores or direct from I. R. Stevens and Co., 510 Madison Ave., NYC. List price is $174.50.

HITCHING A RIDE. This idea for beating highway traffic on a holiday weekend was thought up and executed by the combined publicity departments of two big companies. You guessed it—one is Sikorsky Aircraft. The car? A 1960 Dart.

EASY TO REACH. The lazy Susan rack above was built by a GI at Fort Ord, Cal., to speed the issuance of 202 numbered gas masks. It was made from $23 worth of plywood, salvaged parts from 57-mm. recoilless rifles, and jeep hubs.

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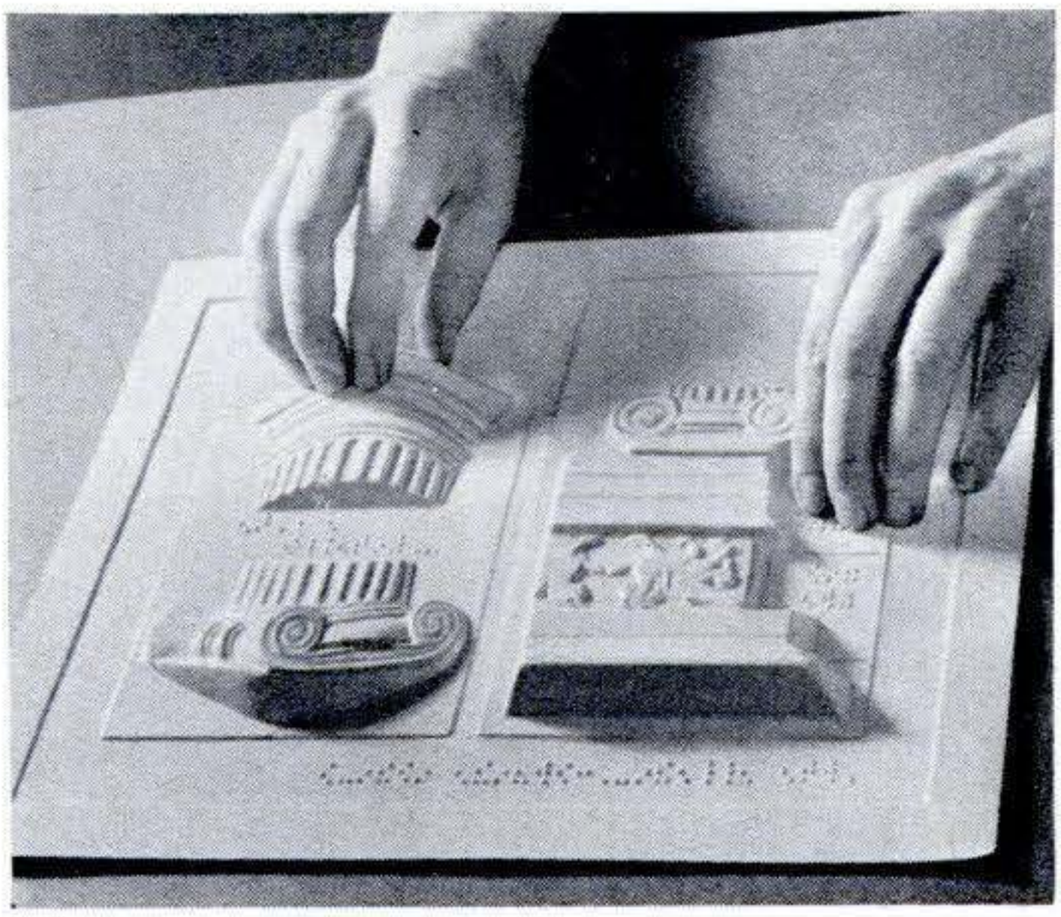
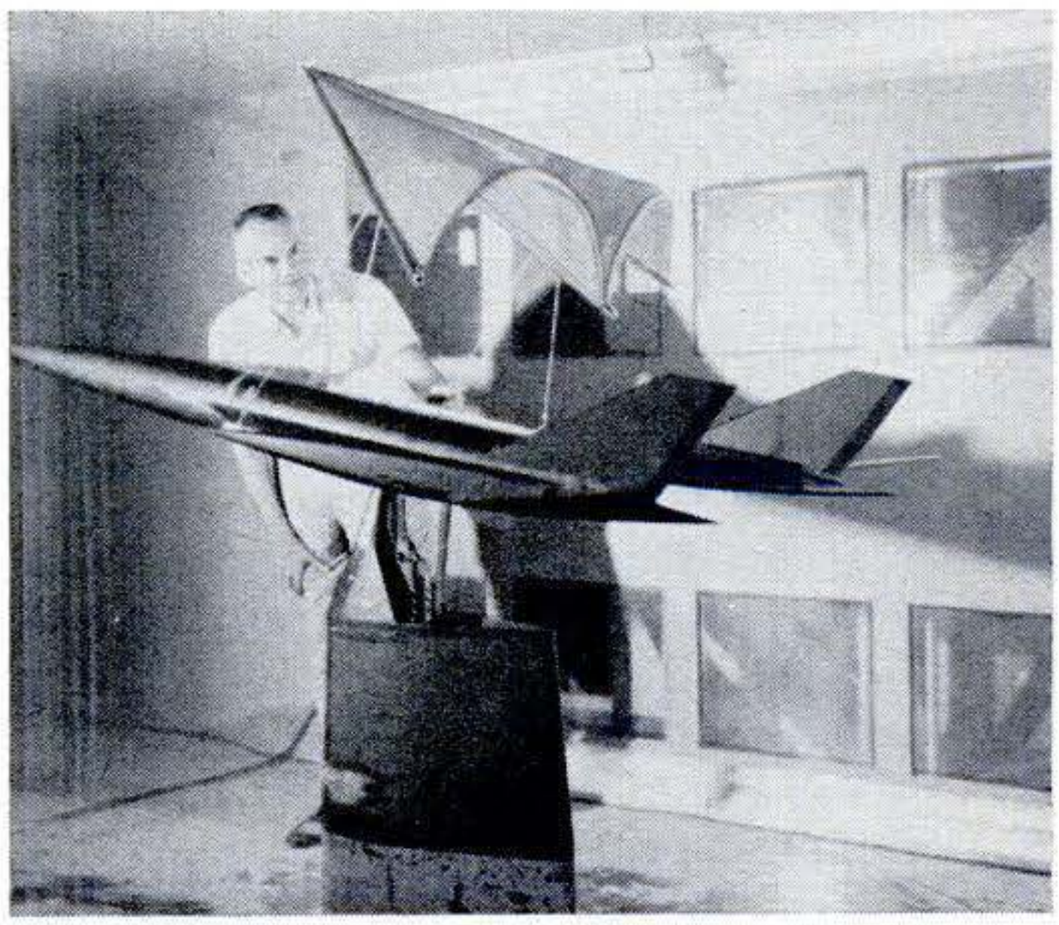
ON THE ROAD, folding scooter goes up to 40 m.p.h. and has a cruising range of 40 miles. One pedal is the accelerator; the other works the rear brake. The seat is foam-rubber padded.



ART IN BRAILLE. The Ionic columns on this plaque bear an inscription in Braille, to teach the blind an appreciation of art and architecture. The plaque is one of a series prepared by the American Foundation for Overseas Blind.



SPACE BRAKES. Auxiliary wing is readied for wind-tunnel tests at Langley, Va., Research Center. Intended for future space vehicles, it would be housed in a top compartment, to act as a parachute on re-entering the atmosphere.

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Backstage at Winter Olympics

$20,000,000 Squaw Valley layout includes electronic computers, magic-eye timers, artificial ice, cannon to shoot down snowslides

By Guy Shipler Jr.

TWO HUNDRED miles northeast of San Francisco lies a steep-sided valley heavy with snow. This month four Army cannon loaded with four-inch shells were unlimbered and pointed at the surrounding mountain slopes, ready to blast away when a critical moment arrives.

The place is Squaw Valley, Cal., site of the 1960 Winter Olympics. The big guns weren't brought in to keep the peace among the 1,200 highly competitive athletes from 31 nations. They are there to keep the athletes and 35,000 spectators from getting buried under avalanches.

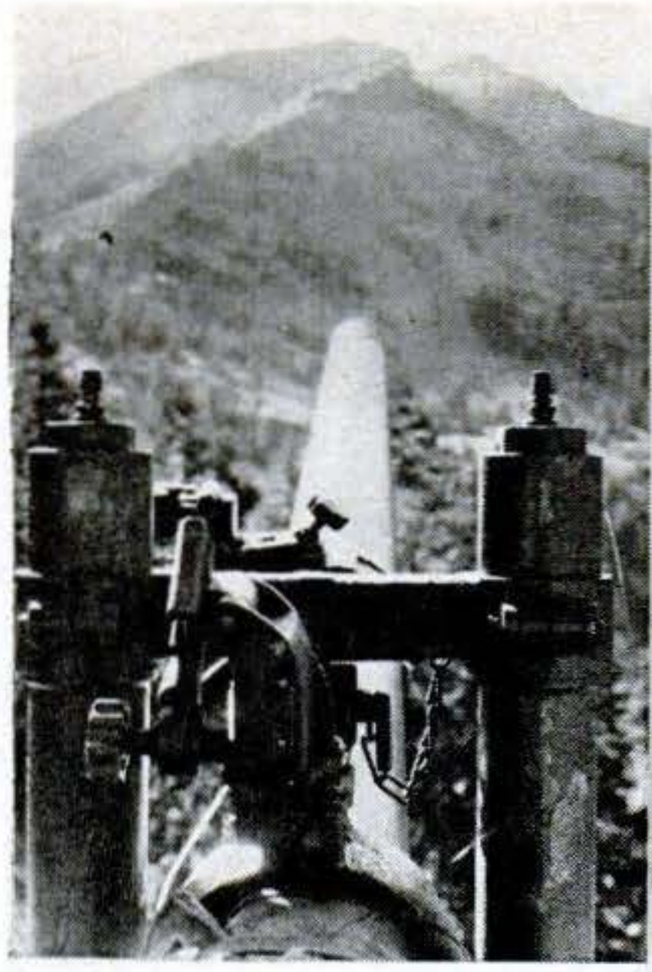
This part of the Sierra Nevada Mountains gets the heaviest snowfall in the United States —more than 40 feet a year. And, generally, most of it falls in February, the month of the Winter Olympics.

Avalanches rate with floods, tornadoes, and hurricanes as among nature's most destructive forces. Hundreds of thousands of tons of snow may hurtle down at speeds up to 175 m.p.h.

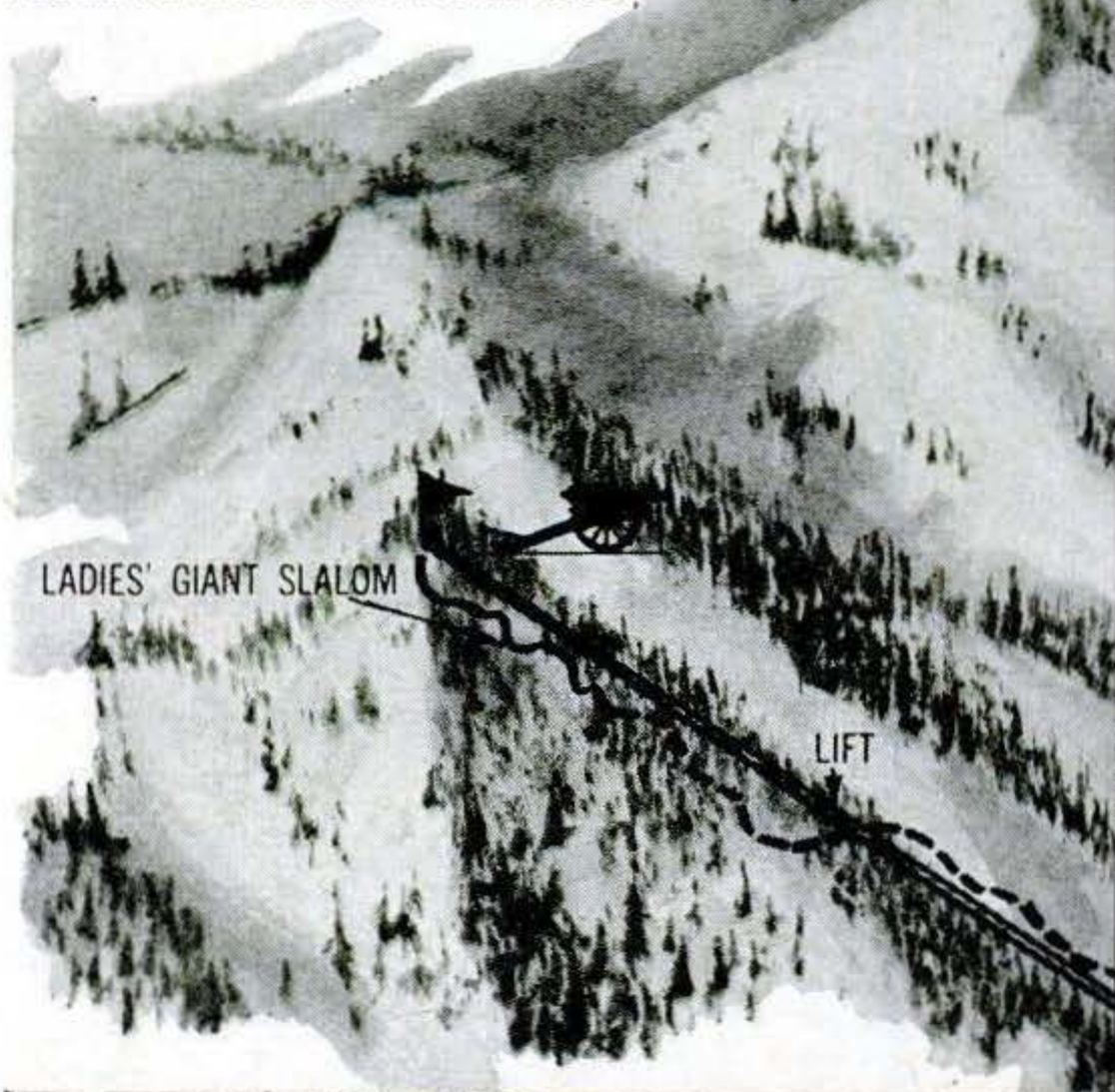
So far no one has figured a way to prevent them. But there are ways to make the avalanches slide ahead of time, before they have grown big enough or top-heavy enough to injure or kill. In Squaw Valley, Army artillerymen will blast them loose.

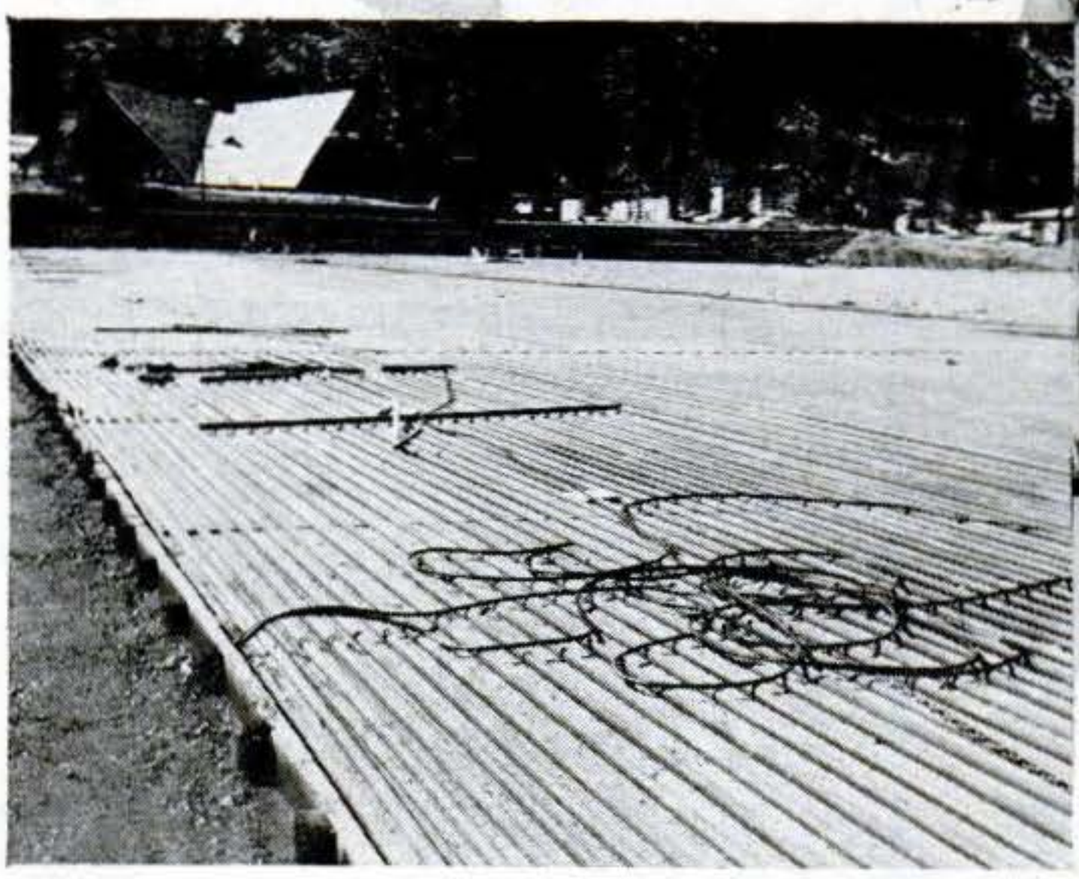
Knowing when to shoot. For the avalanche expert, there are three danger signs: rapidly falling snow that refuses to settle, and is dry and crystalline; temperatures dropping below 15 degrees; wind blowing faster than 25 m.p.h. When these signals appear simultaneously, zero hour has arrived for snow-nudging teams to go into action.

Though the avalanche-fighters depend on



BIG GUN stands ready to break up potential avalanches on Squaw Peak, scene of men's downhill race.





ARTIFICIAL SPEED TRACK, first such ice rink ever used in Olympics, contains 70 miles of pipe. Linked to a 600-ton refrigeration plant, thermostatic controls will keep the surface smooth.

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SQUAW PEAK
MEN'S DOWNHILL
TRAM
MEN'S GIANT SLALOM
LADIES' DOWNHILL
LIFT
LIFT
MEN'S SLALOM
OLYMPIC VILLAGE
LADIES' SLALOM
SKI JUMPS

ARENA ROOF has an opening at the ridge. This permits the roof structure to move up and down as much as 22 inches, as snow load and temperature changes cause cables to expand and contract. Corrugations carry heat to melt snow.

CONTINUED

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their experience to tell them when the danger hour has arrived, a pair of experts, Richard Stillman and Monty Atwater, have invented a forecasting machine that anybody can read. It consists of 15 disks, like poker chips, strung at two-inch intervals on three cords hanging from a steel, spring-type tape measure. Snow falls on the chips. If it settles, the weight pulls the tape spring, an easy-to-read signal that there is no immediate danger of an avalanche. If it's porous snow, containing too much air, it won't settle and the tape won't budge. That means danger.

Taming a wilderness. Previous Winter Games have been held at sites where facilities existed. Until it was chosen for the 1960 Games, Squaw Valley was known only to a handful of dedicated skiers. The builders had to start from scratch, tailoring everything from housing and dining halls to stadium and ice rinks. As a result, some startling new ideas were used in this $20,000,000 layout.

From the valley floor, 6,200 feet above sea level, construction teams bulldozed twisting roads up the tough, 9,000-foot peaks to install chair lifts. While some slashed championship ski runs through thick pine forests, others molded a ski-jump hill out of the side of a mountain. Great diesel trucks chuffed in with tons of steel and concrete.

CONTROL POINT under arena permits flexible and accurate thermostatic control of ice surfaces. The system uses calcium chloride brine and Freon-12.

Skating races, for the first time in the history of the Games, will be held on artificial ice. A refrigeration plant, big enough to run the refrigerators in 4,800 homes, will keep ice at just the right degree of hardness on this rink and on four others for figure skating and hockey.

Refrigeration generates heat. This heat will be used to warm spectators, provide hot water for showers, and melt snow on the roof of a main arena seating 9,000 spectators.

The arena roof is a marvel in itself. It's designed to move up and down as much as 22 inches as snow load and temperature cause its supporting cables to expand or contract.

Timing and scoring. The 1960 Winter Games will be the most accurately timed and scored sporting event ever held. Basis of the system is some $200,000 worth of precision timing equipment developed by Longines. Heart of it is a Printing Timer, with a quartz clock as a time standard. The quartz clock is more accurate than celestial observations.

Slalom racers—they're the fellows who zing down mountains on a zigzag course—will be timed as they go through a "gate" at the start and again when they break a light beam at the finish.

Hockey games will be timed by electric clocks to within a tenth of a second. If a puck slamming into a cage is a fraction of a second behind the end of a period, a red light will signal NO GOAL.

Dead heats in races will be unlikely because of timing devices measuring accurately to hundredths of a second.

The whole timing installation is dual, to insure against failure. Moreover, all systems are interconnected: If an avalanche knocks out the downhill timing system, timing impulses can be shunted across to the slalom system. The wiring runs the ridges to connect all the systems as needed. And against the long chance that all systems fail, there will be official timekeepers clocking all events manually.

Eliminated, too, will be the long delays while results are calculated. (Complex data on some events in past Olympics took as much as five hours to compute.) This year the data will be processed within two minutes by an IBM electronic computer, which will print the results simultaneously in English and French.

No attempt will be made to remove snow from the valley's 12,000-car parking area. Instead, Navy compaction machines will crunch it down in layers—a layer of snow, then a layer of sawdust. The surface will be as hard as rock.

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Here is crash insurance for the fine model on which you have spent so many hours of loving work

Knee-Spring Struts for Control-Line Planes

By Joseph Whitehill

ONE of my friends who builds highly detailed control-line model planes calculates that he spends an hour and a half at the workbench for every airborne minute he achieves. Sweeping up the ruins of a plane he has spent two months building, he says sadly, "Well, that's the way it goes."

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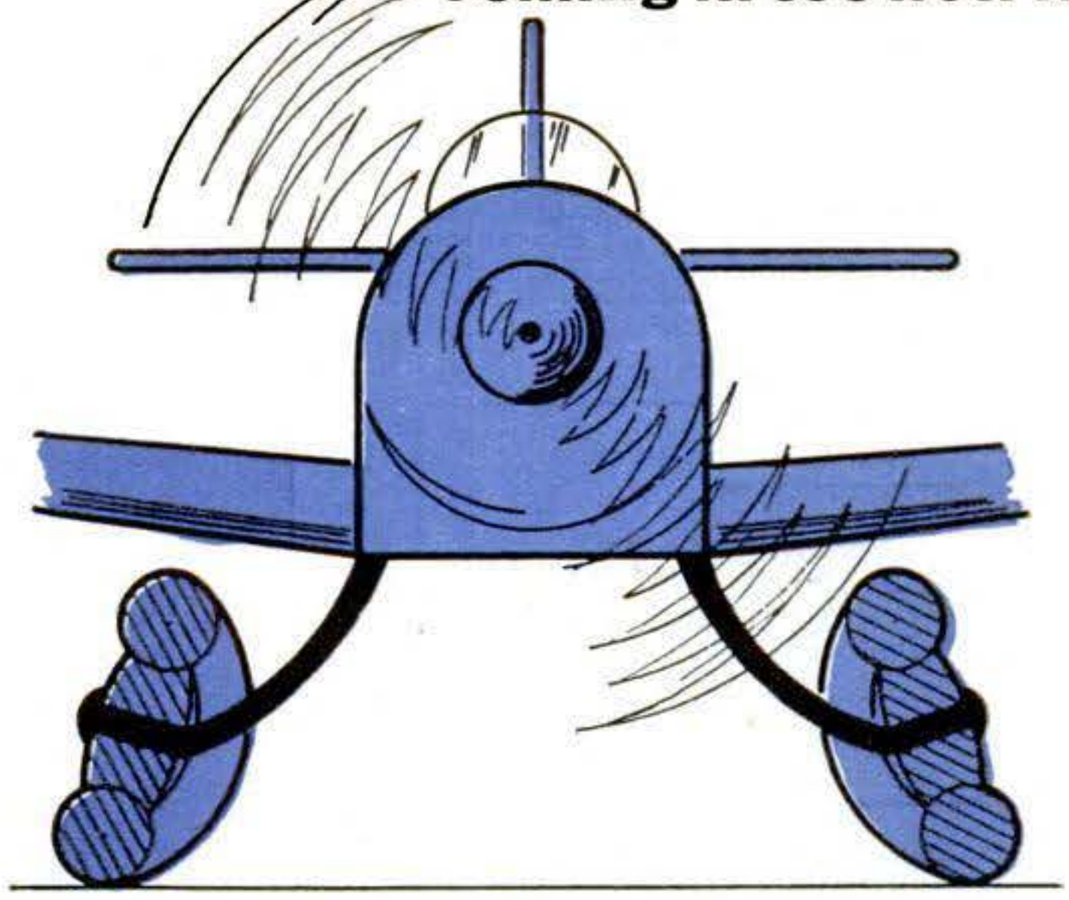
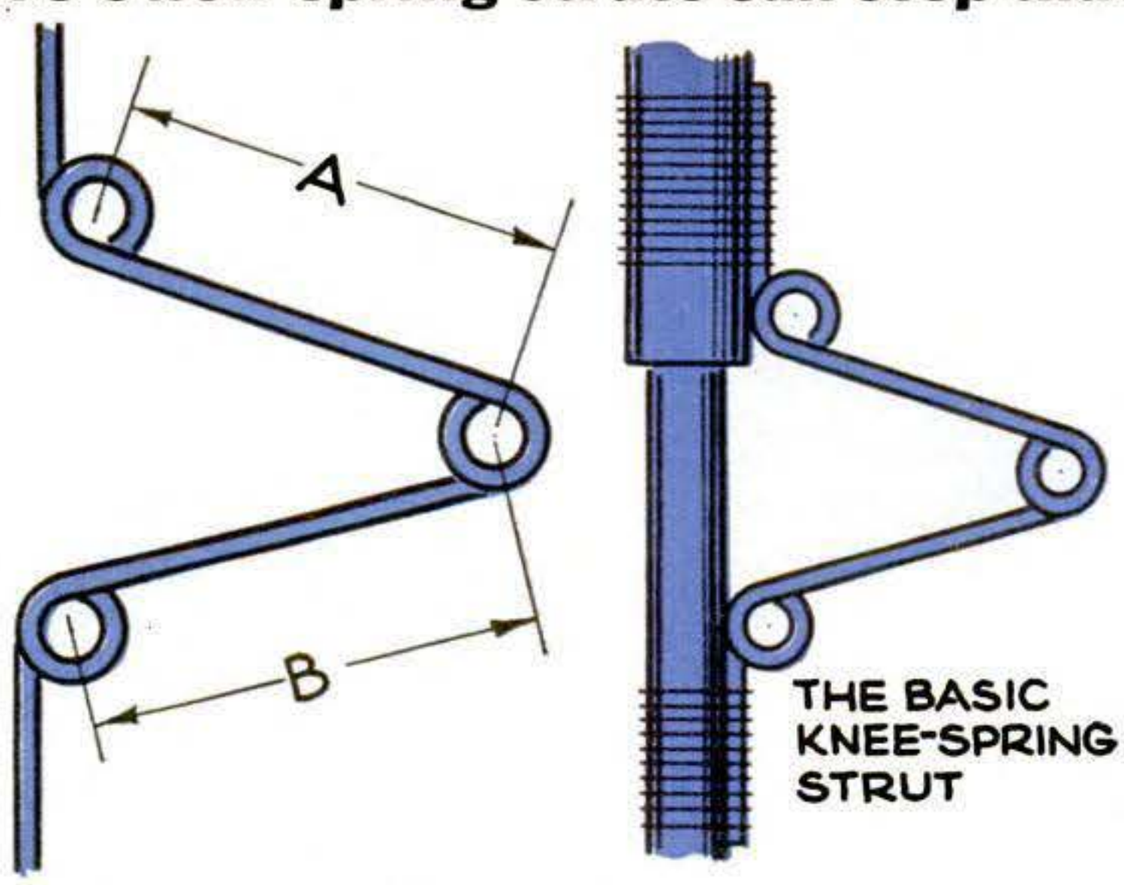
Coming in too hot: Here's how spring struts can stop that



WHY PLANES CRASH: Conventional landing gear bends on impact, causing wheels to bind and trip plane into nosing over. Knee springs absorb shock and keep wheels rolling freely.



BASIC KNEE SPRING is simply a wire bent with three loops as shown. Lower leg "b" is slightly longer than upper leg "a" to account for smaller-diameter tube to which it is attached.

But does it have to go that way? No. First, note that there are relatively few *flying* failures. Nearly all accidents happen because of faulty landings.

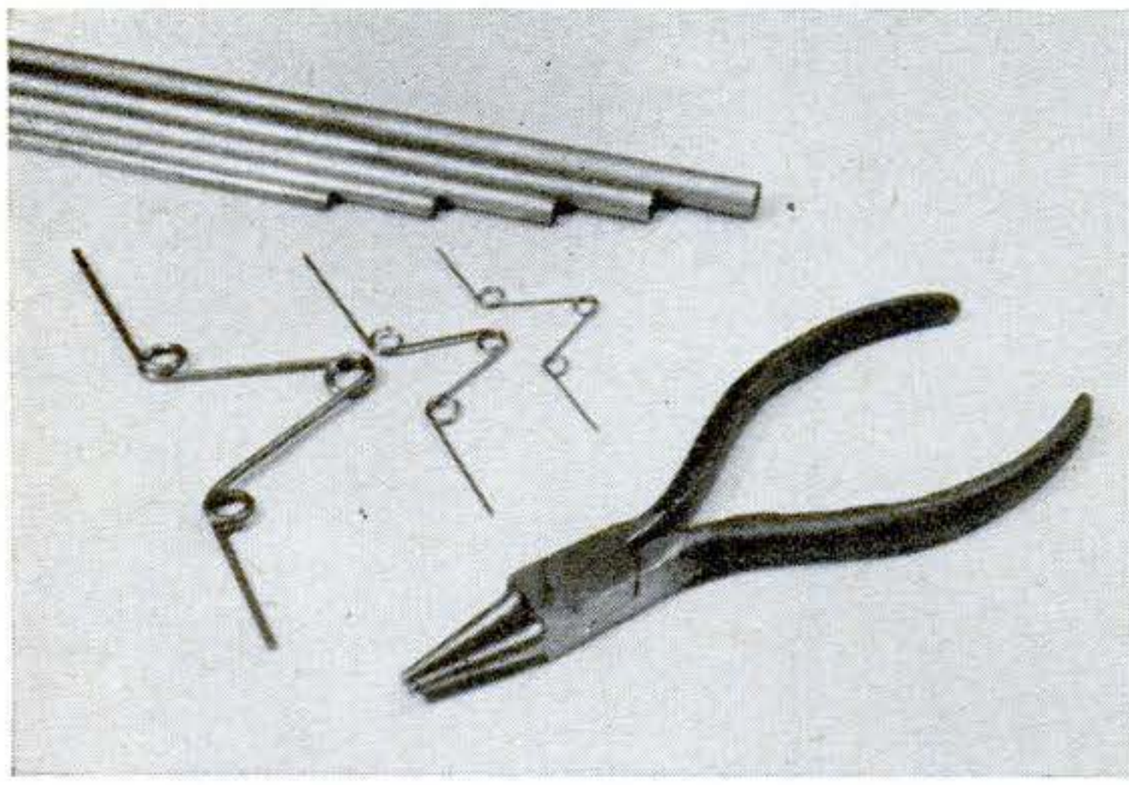
A typical landing goes like this: The engine falters warningly a couple of times, telling you to lose altitude at once. You do this and fly level at waist height until the engine quits and that sickening slack comes in the lines. At this point you have a choice of either panicking or keeping your head.

If you panic, you haul back on the stick too abruptly, the plane shoots up in the air, whipstalls, and comes down hard. If you keep your head, you will ease the stick forward to lose altitude at a uniform rate, then level out about six inches off the ground and stall it in neatly, making a safe landing.

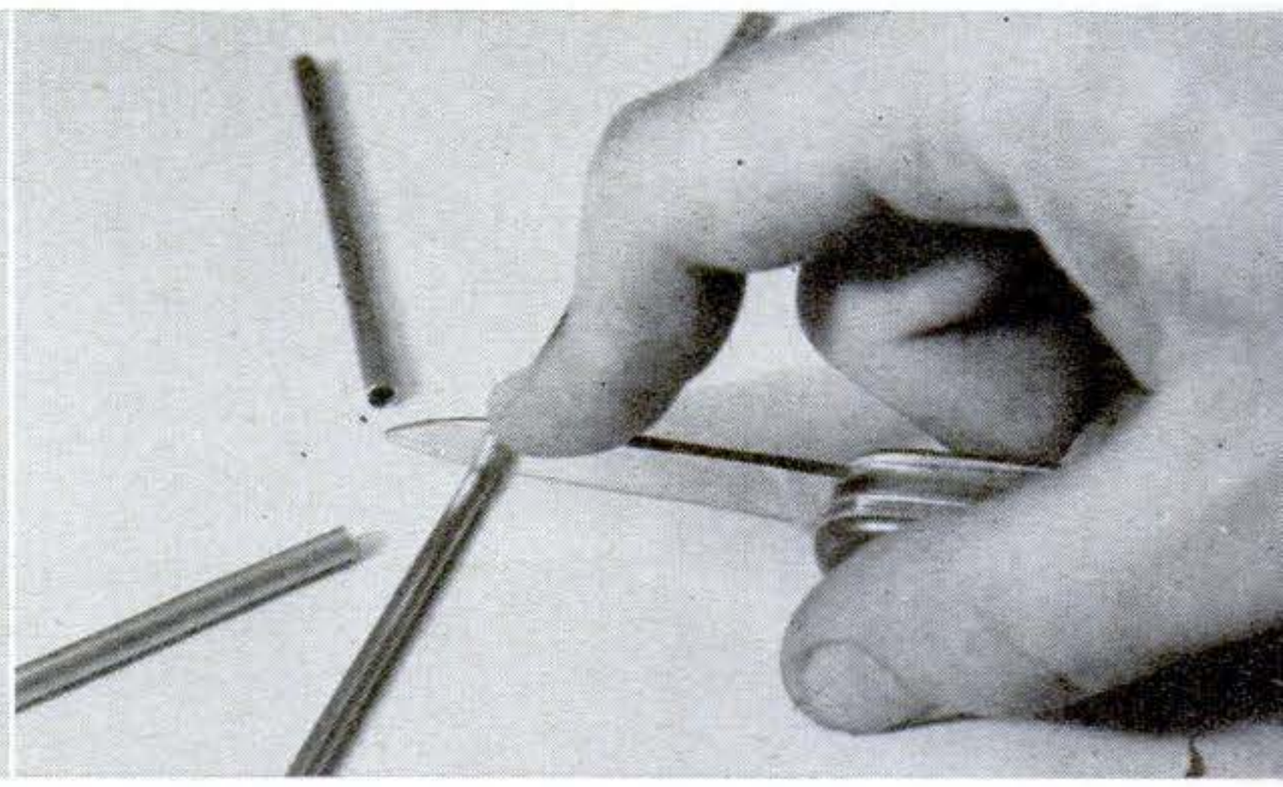
In between the panic stall, which no plane can survive, and the skimming, pretty setdown are many marginal landings where an improvement in the landing gear can spell the difference between safety and disaster. Your model comes in a little too hard, and what happens? The conventional plain wire wheel struts fail just when they are needed most. They bend outward and the wheels drag, slowing the plane so abruptly that it noses over on its back.

The answer lies in a simple knee-spring wheel strut that will compress as the

Wire, tubing, and solder are all you need to assemble your own



ASSORTED SIZES OF WIRE can be used to vary spring stiffness according to weight of model. Tiny brass tubing, available at hobby shops, is used for telescoping parts of the struts.



BRASS TUBING can be cut easily to length by rolling it slowly back and forth under a sharp knife, as above. Each size of tubing makes a good sliding fit in the next larger diameter.

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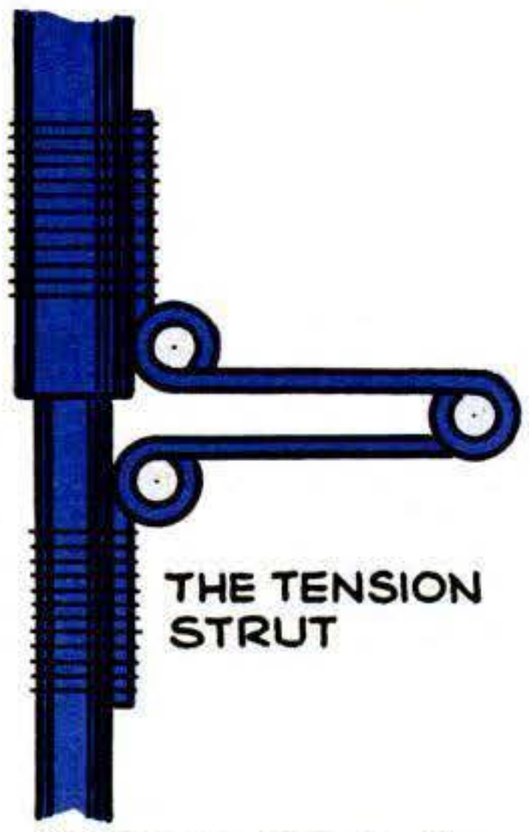
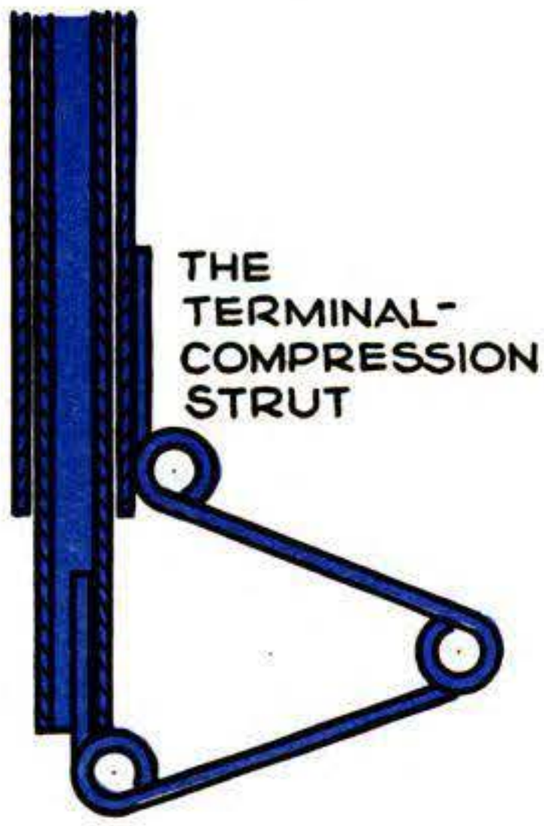
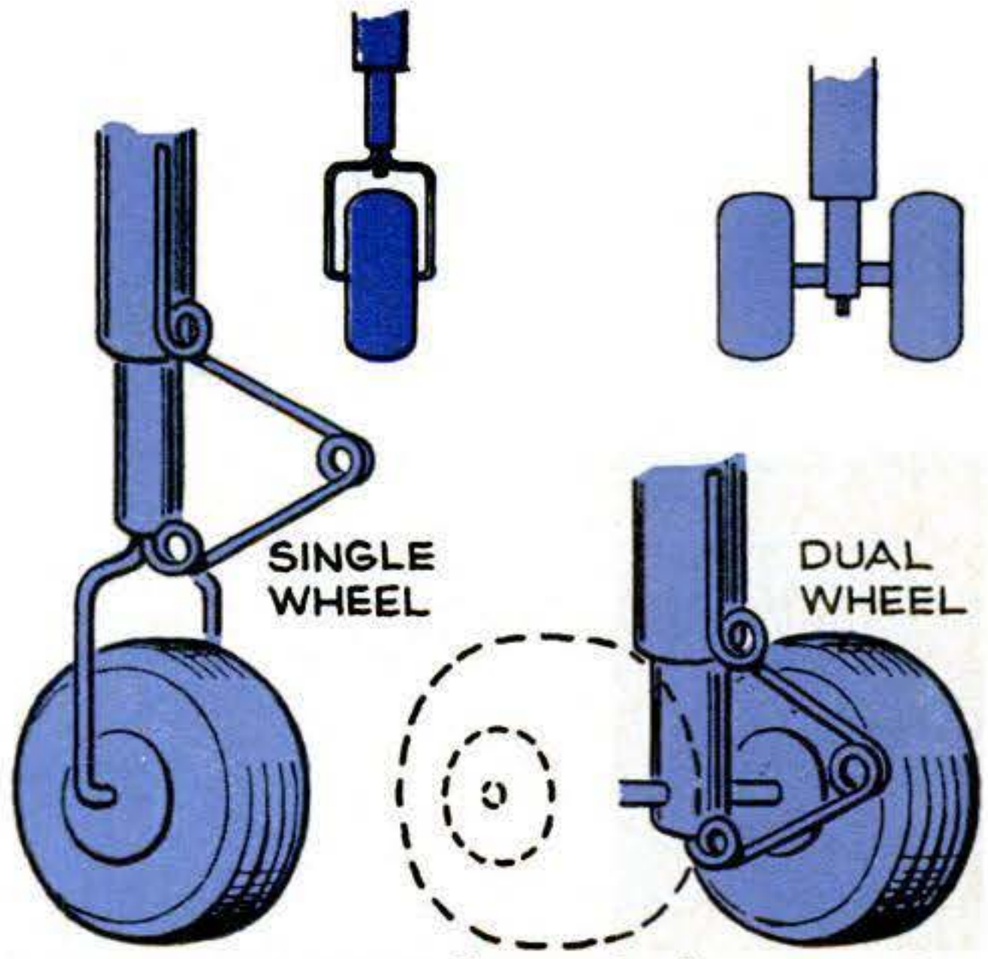
heartbreaking shower of balsa





TENSION STRUT, though not often needed, can be made with spring legs parallel (above, left) so they pull when stretched. "Terminal-compression" strut at right pushes tubes apart.



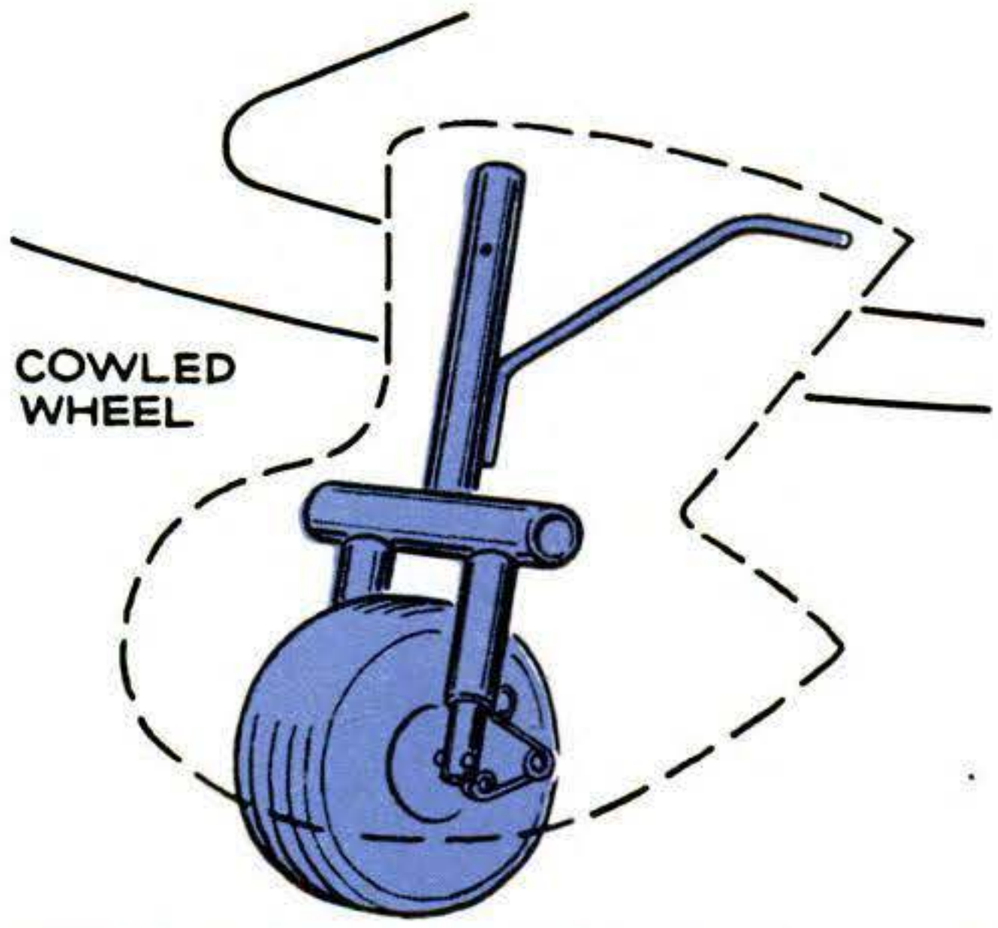
MOST POPULAR STRUT is terminal-compression type because, with spring at bottom, axle can be soldered directly to end. It easily permits either single- or dual-wheel units.

wheels strike the ground and absorb the shock without bending. This would keep the axles in line so that the wheels couldn't drag. With the wheels turning freely, a plane could hit the ground with a relatively hard smack and still roll on to a safe landing.

All the materials required to build knee-spring struts are available in most hobby shops—assorted telescoping sizes of hard-drawn brass tubing, music wire, radio solder, and small, soft-drawn copper wire.

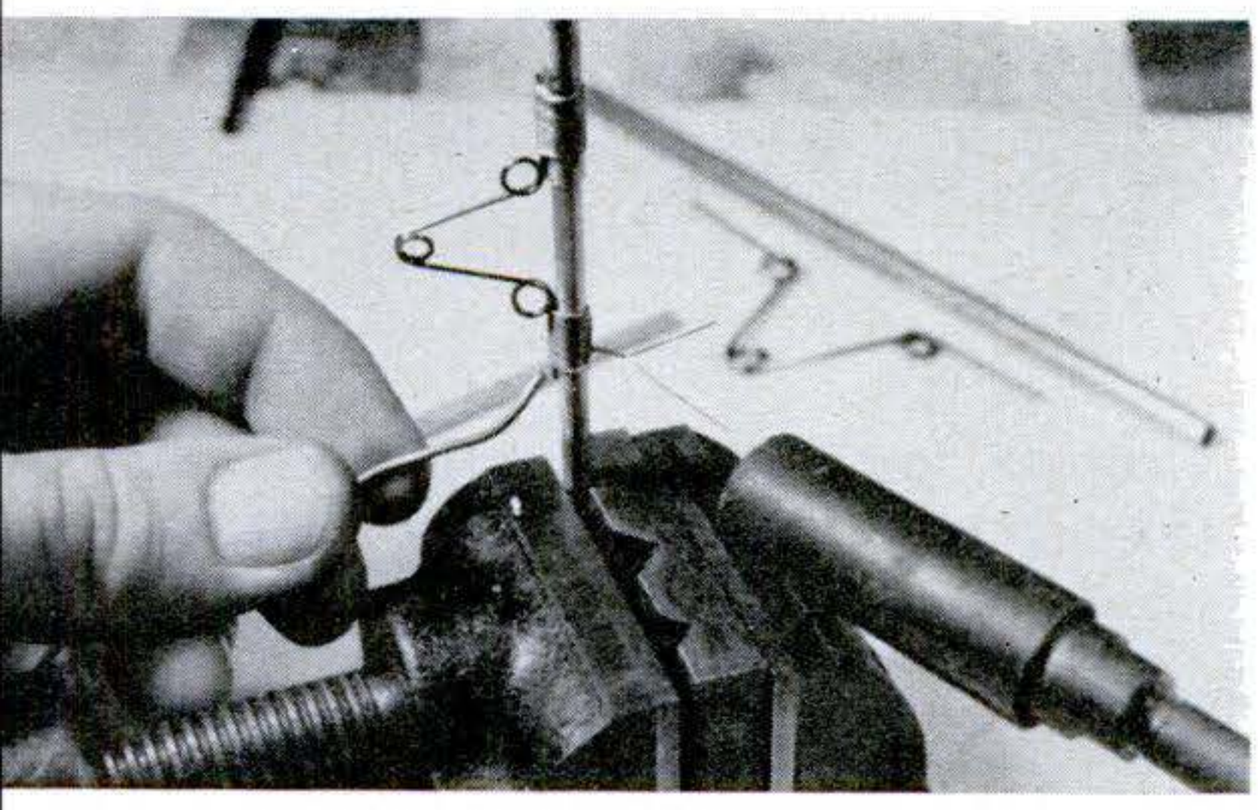
Just by hand-forming music wire in the jaws of a small pair of round-nose pliers, the basic knee spring can be given

[*Continued on page 244*]

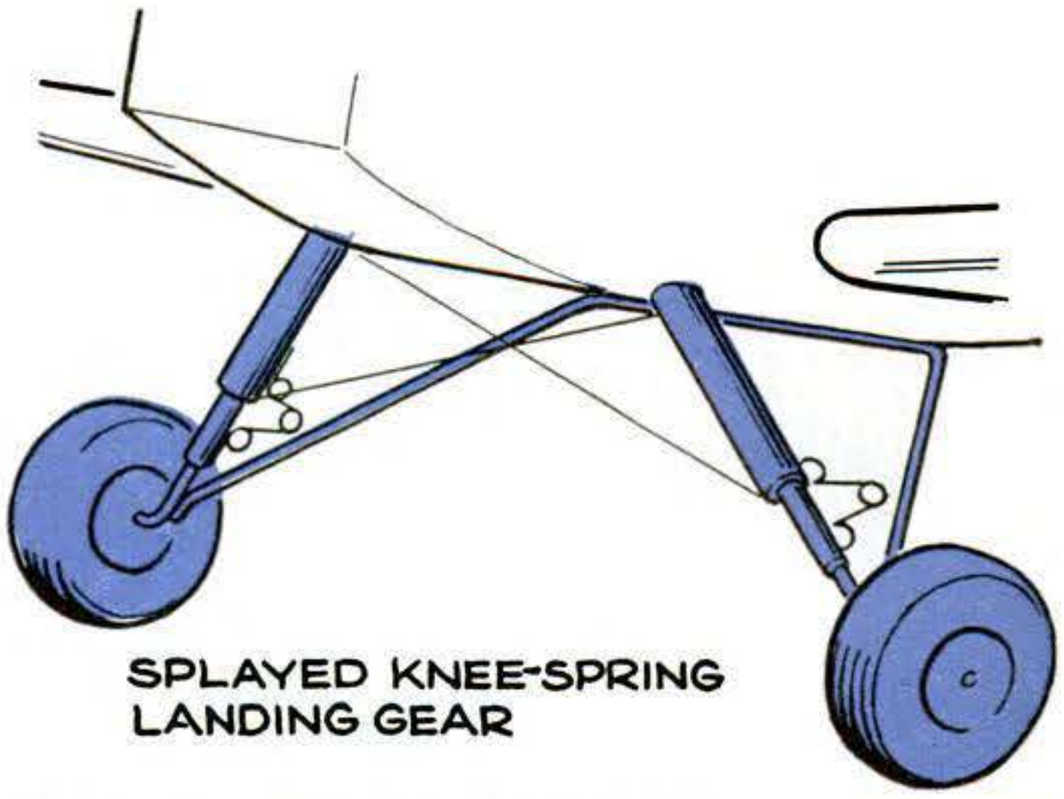


WHERE SPACE IS CRAMPED, as inside a cowled wheel like this, two tiny light-duty springs can be combined in a simple clevis arrangement avoiding use of an overlarge spring.

knee-spring struts like this



SOLDERING SPRING TO STRUT is most important step for strength. Ends of spring are bound with wire, but only for temporary support. Be sure to get a solid, wet-flowing solder bond.



REAL-LOOKING LANDING GEAR not only saves crashes but improves appearance of fine models. Above are replacement spring struts for standard type found in primary trainer kits.

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Short Cuts and Tips

FROM PS READERS

How to Shape a Heart Cake

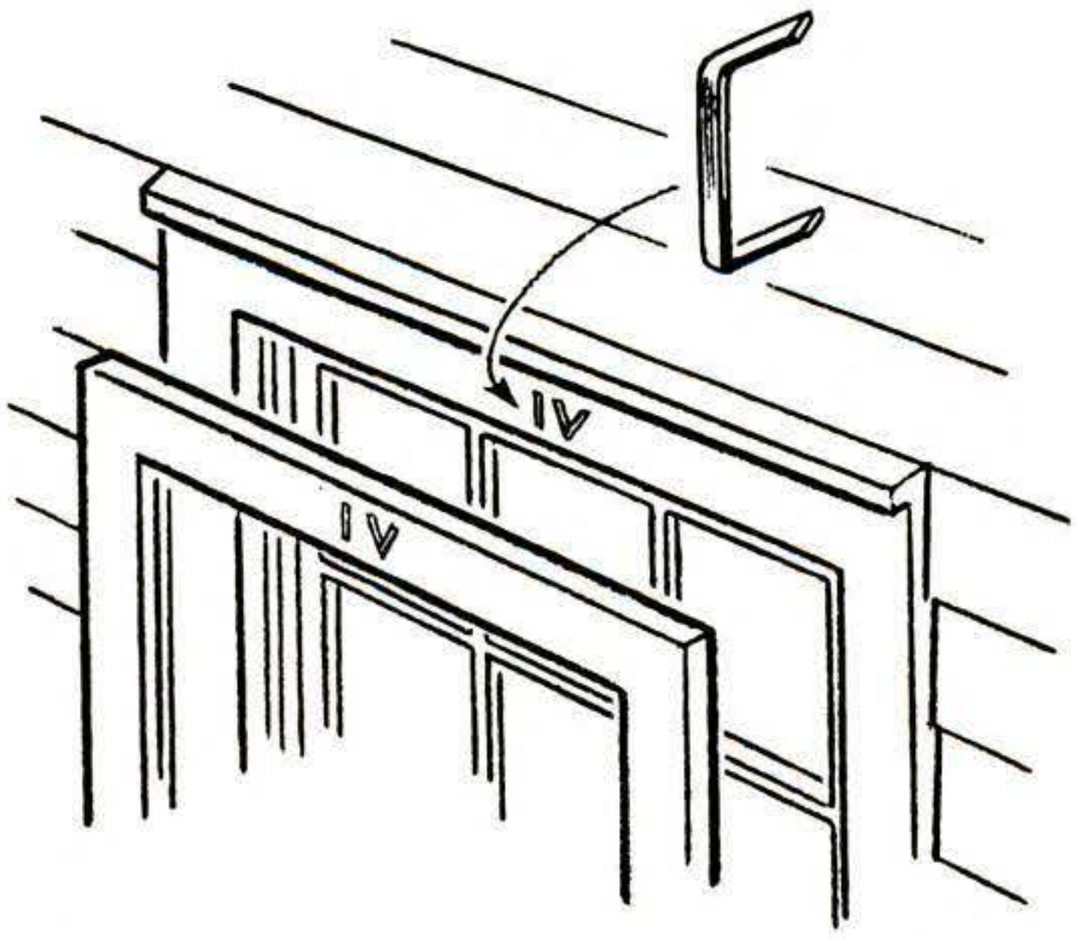
TELL your wife she can make a St. Valentine's Day cake with a round pan and a square one if the diameter of the first equals the side dimension of the second. After a cake has been baked in each pan, the round cake is cut in half and the halves are then placed against adjoining sides of the square cake as in the inset sketch. —*Betty Rooker, Redondo Beach, Cal.*

▶▶▶WHEN patching rough cement, go over the work with a wet brush just after the cement has started to set. This smooths out the patch and blends the edges into the surrounding cement surfaces.—*J. E. Cushman, Stonington, Conn.*

▶▶▶IF YOU'RE building a new house, have the masons install a chimney TV-antenna socket—a 3′ or 4′ piece of 2″ pipe between the outside brick and the flue lining. The cement cap will hold it firmly in place.—*A. E. Bryant, Lynchburg, Va.*

Helping Skunks Over the Top

DOWN in the Great Smoky Mountain National Park hungry small animals—including skunks—kept falling into garbage cans. They couldn't get out and smelled things up. Now they climb out on an escape ladder—a rough one-by-two attached by screws inside the waste container.—*Fred J. Overly, Gatlingburg, Tenn.*



Numbers for Storm Windows

ROMAN numerals, formed with a stapling gun, are an inconspicuous way to identify the location of storm and screen windows. Place the staples at the top of each removable window sash, and in a corresponding position close by in the matching window casing.—*H. B. Jackson, Boise, Idaho.*

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How to Install a Stairwell Closet

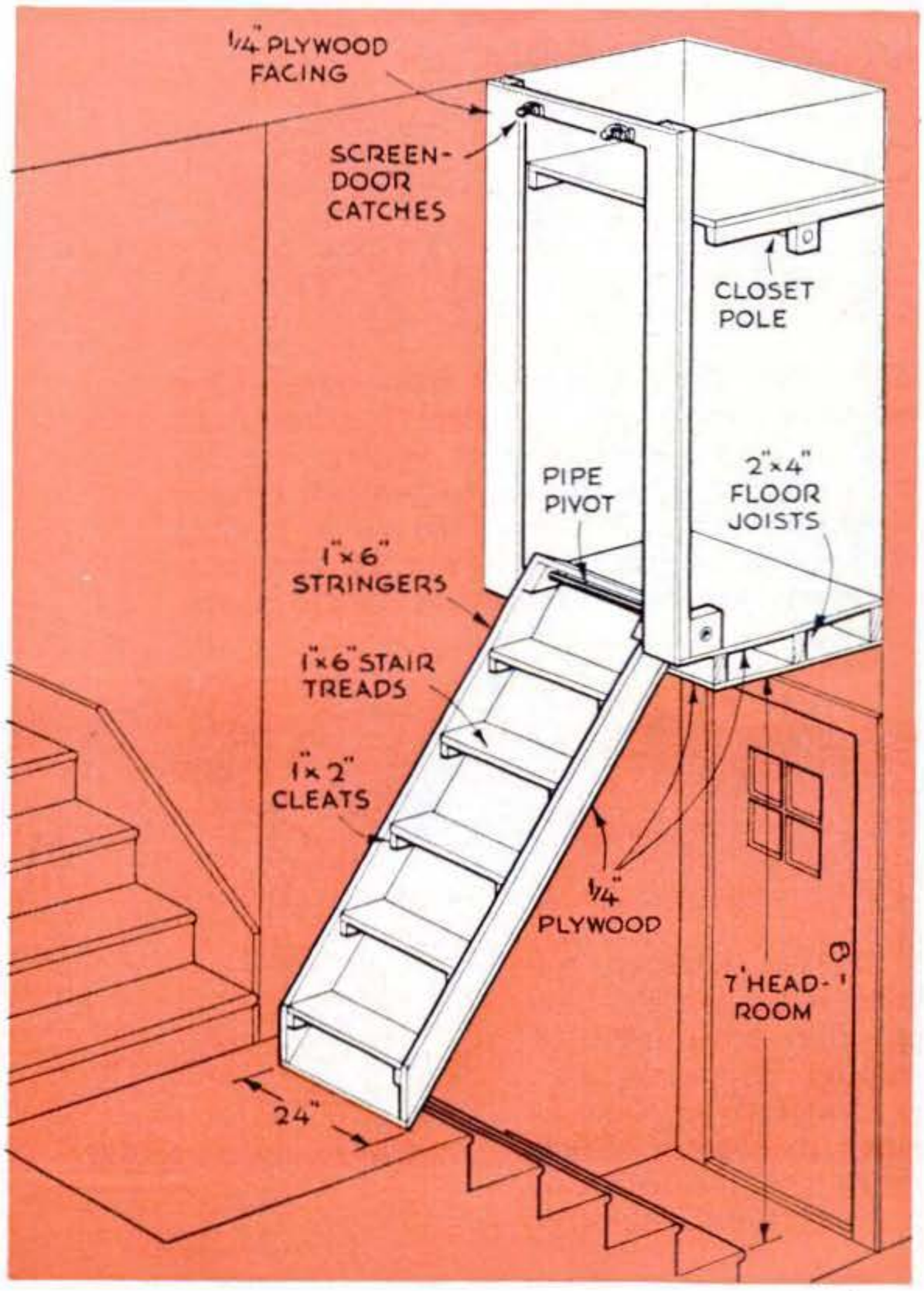
THE waste space at the top of a stairwell is a perfect place to put that extra closet for seasonal storage. Most stairwells are up to 16′ tall, leaving at least 6′ that can be safely enclosed without stealing head room. Since you already have three sides and a ceiling, all you need is a floor and front.

Into my closet I built a set of drop-down steps that also serves as the door. This makes it easy to reach stored articles without dragging out a ladder. When not in use, the steps swing up and are held closed by a pair of screen-door catches.

The kind of split-level stairway that has a landing part way down is ideal for such a closet, because it gives you easy access to the door. A similar arrangement can be worked out for a straight staircase, but it's harder to raise and lower the steps.

The step-door pivots on a length of ½″ pipe that passes through holes in the ends of the stringers. The ends of the pipe extend 2″ at each side and fit into notches in wood blocks that serve as bearings.

Bear in mind, of course, that the exact location of the pivot point depends on the length of the steps and how far they swing down. I experimented by swinging a board up and down until I found how high the pipe had to be to keep the steps from binding. A window pole unlatches the steps, and raises and lowers them.—*Verner E. Pearson, Chicago.*



HIDDEN STEP-DOOR is automatically held closed by its own weight as it swings past pivot point at bottom. Swung open as at right, steps provide quick access to new storage closet built at the top of the stairwell.

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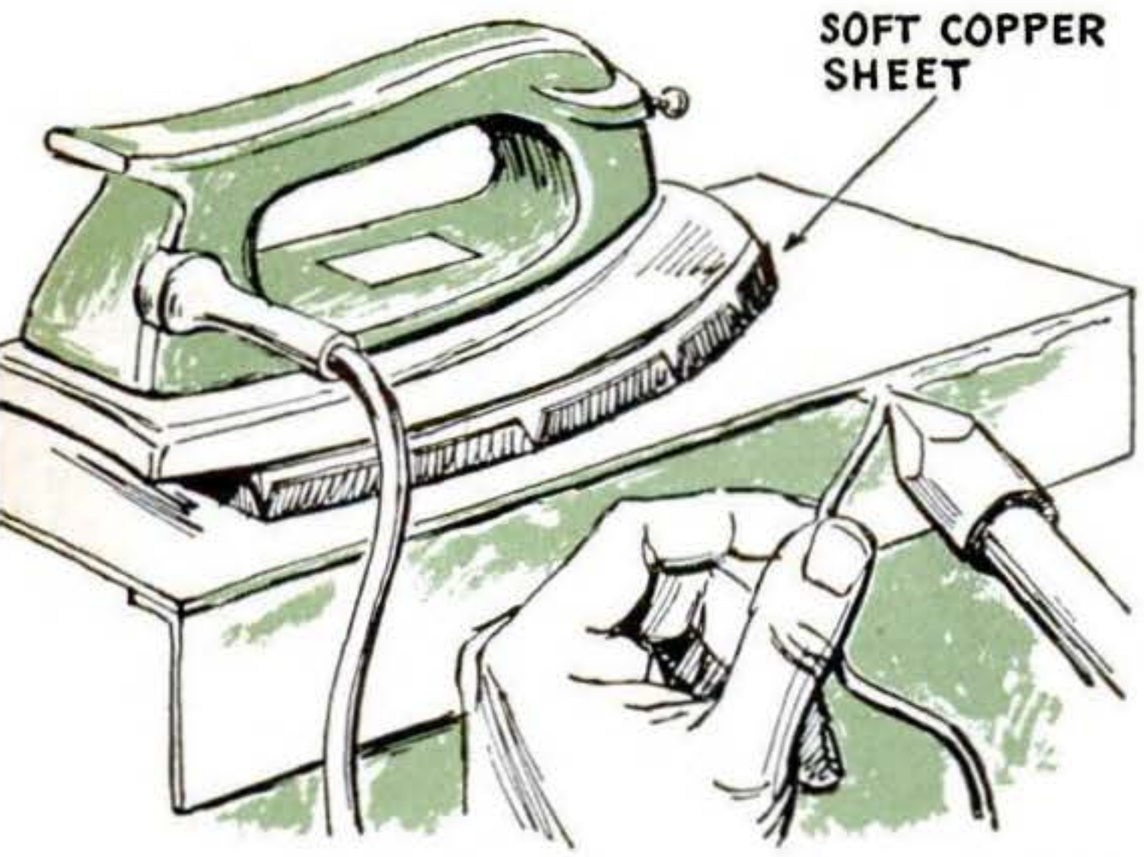
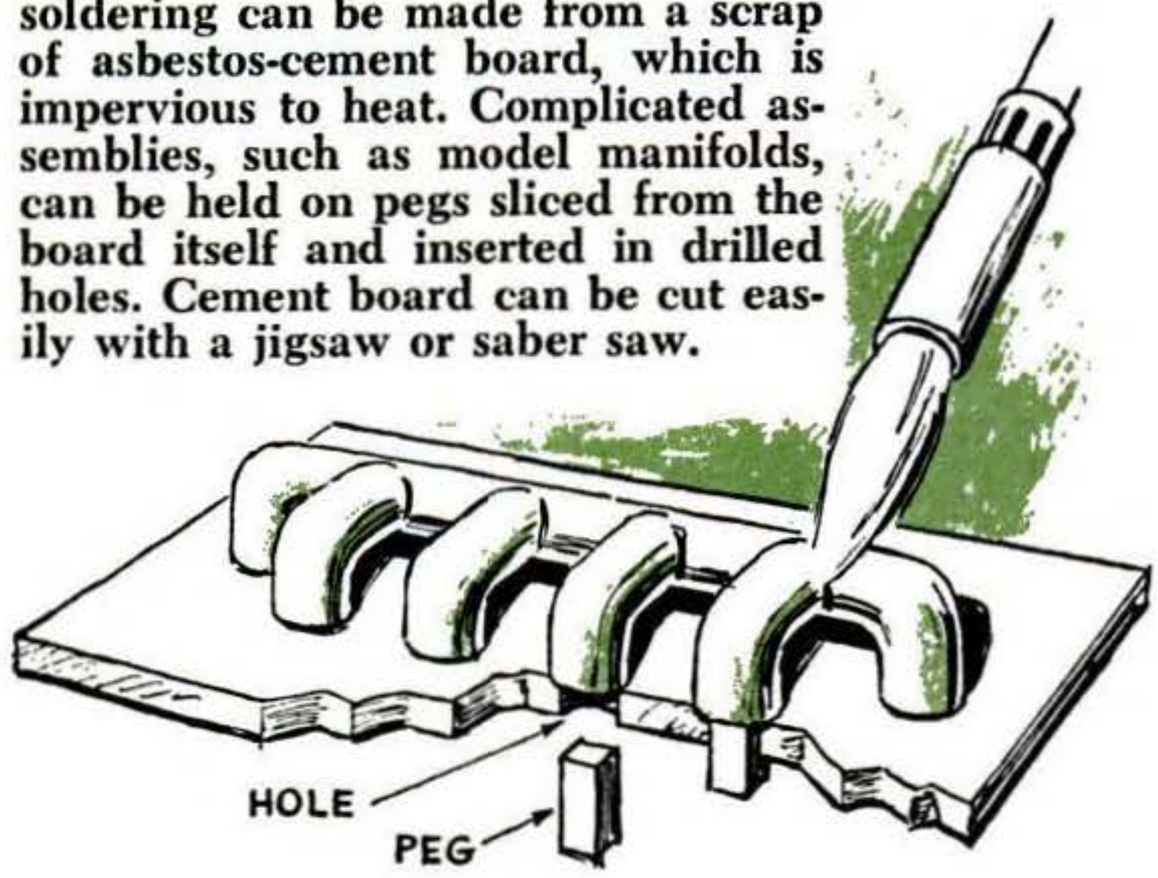
YOUR IRON WILL HEAT FASTER and stay hotter longer if you slip the tip into a length of pipe this way. The pipe holds the heat in.

Tips for a



EXTRA HEAT from a pressing iron is useful for soldering large sheets of metal that lose heat quickly. Clip a shield of soft copper over the sole of the iron, as above, to protect it from solder and flux. Clamped face up in a vise, the household iron becomes a handy shop accessory for sweat-soldering small parts.

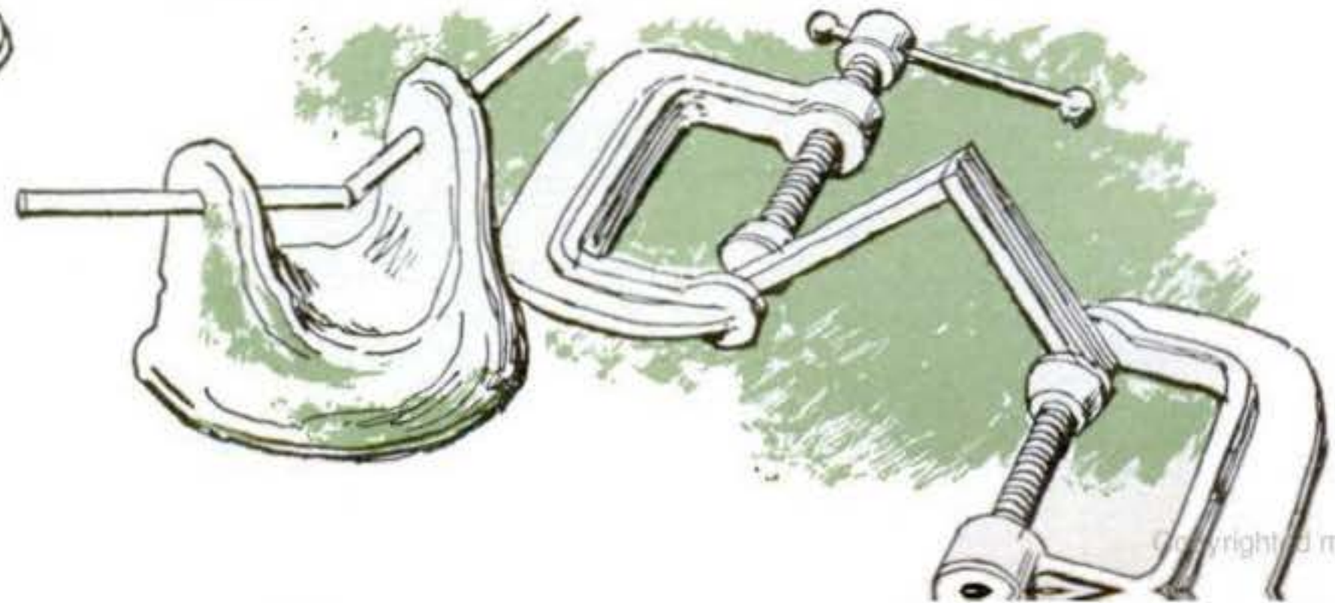
A FIREPROOF JIG for brazing or silver-soldering can be made from a scrap of asbestos-cement board, which is impervious to heat. Complicated assemblies, such as model manifolds, can be held on pegs sliced from the board itself and inserted in drilled holes. Cement board can be cut easily with a jigsaw or saber saw.



BRUSH KEEPER: You'll never have to look for the brush if you solder the metal handle to the lid of a solder-paste can. When the lid is removed, it serves as a holder to keep the brush off the bench when you set it down between soldering jobs.

A SWIVEL HOLDER for your iron, which also has the advantage of keeping it warm, can be mounted on a workbench as shown. When not in use, the iron can be swung out of the way.

ADJUSTABLE JIGS to hold small parts at odd angles while you solder them can be improvised quickly. Use a pair of C clamps, laid flat on the bench (below right), or shape modeling clay to hold the parts, as illustrated at the left.



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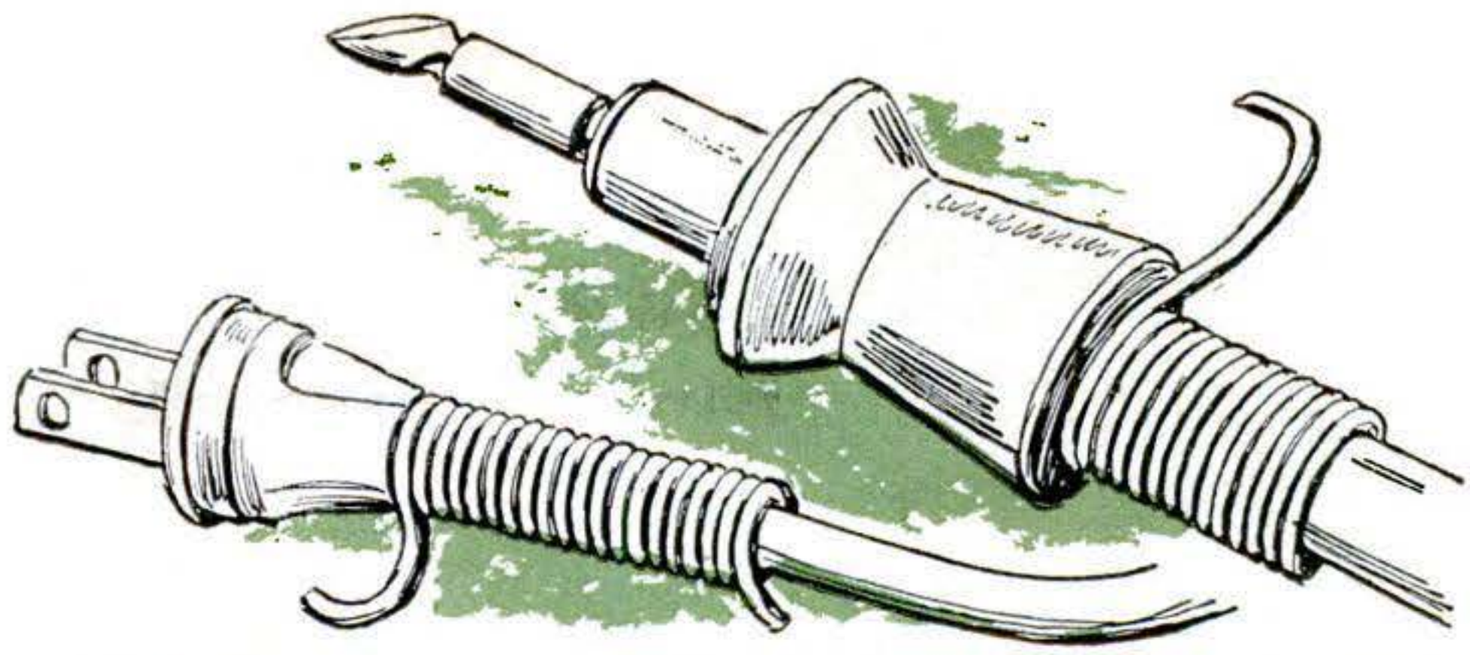
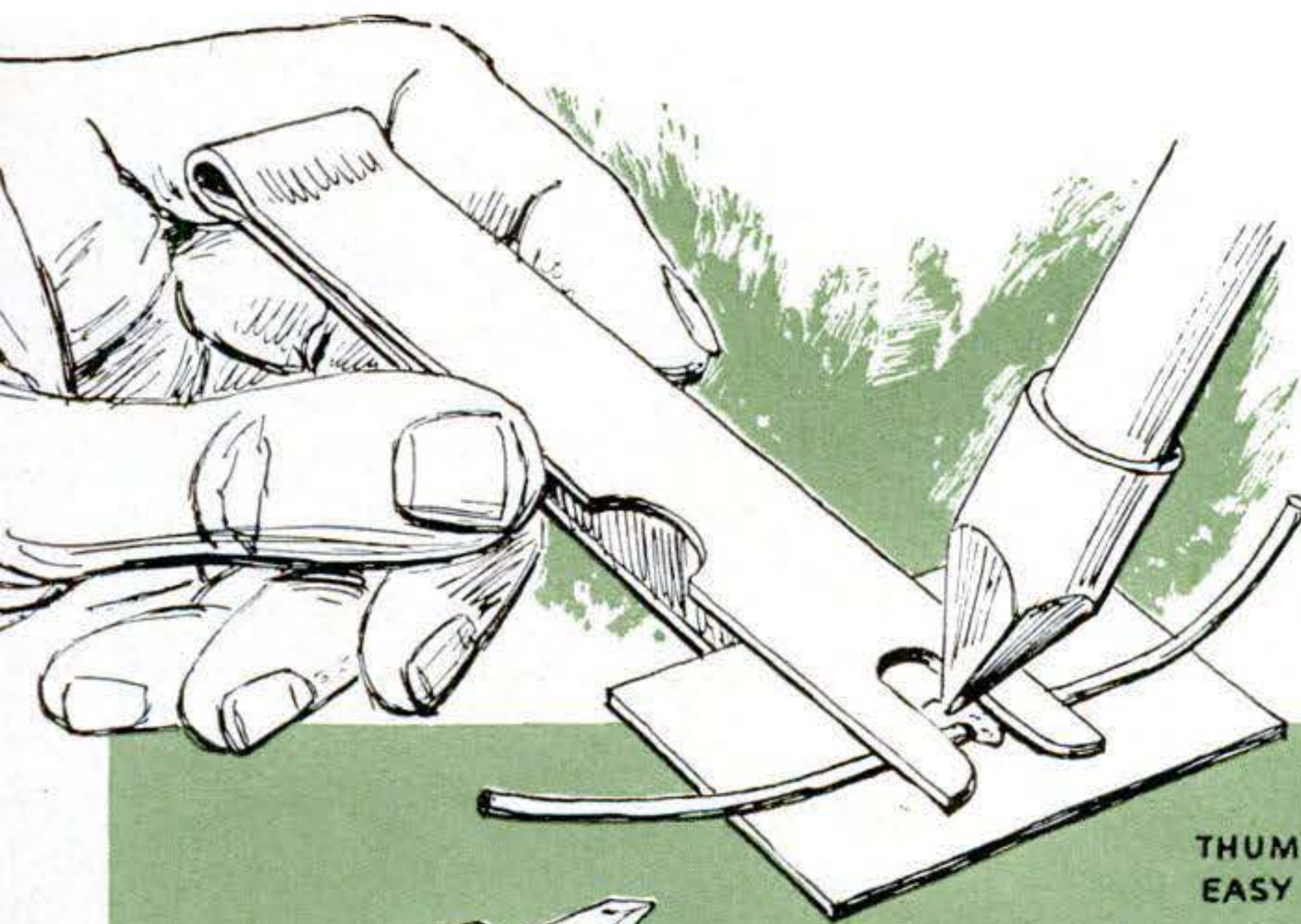
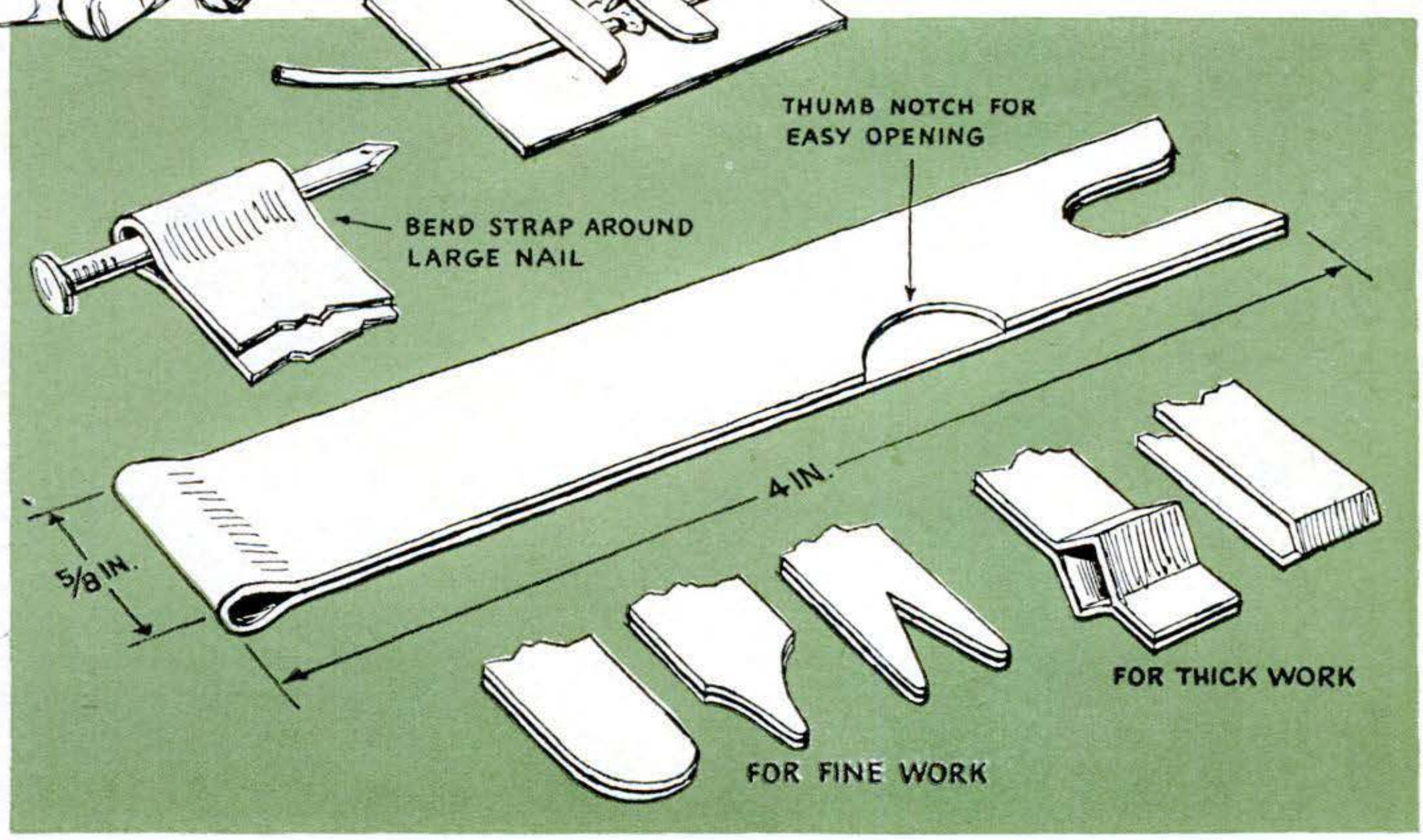


SOLDER IS ALWAYS HANDY if you keep it wrapped around the handle of your iron (upper sketch). Another trick is to wind a short length around the cord near the plug (lower sketch).

Better Solder Job



A ONE-HAND CLAMP that you can easily make will hold tinned parts in perfect alignment while you use the iron with your free hand. It's shaped from stainless-steel TV-antenna strap, available from radio-supply stores. This won't hold solder. Bend a short length around a large nail to form a spring loop at one end. Then file a U-shaped slot at the tip. Other shapes can also be made, as shown in the drawings below, to hold different types of work.



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Short Cuts and Tips

FROM PS READERS

Self-Unloader from a Spreader

WHEN Lief Garver of Boardman, Ohio, needed a self-unloader to speed farm crops into bin or silo, he removed the big beater from the rear of his manure spreader. The power take-off on the tractor drives a shaft that operates chain webbing on the wagon bed, pushing out corn or other materials onto the elevator.

▶▶▶NEXT time you have to replace a hard-to-reach fuse in a TV set or elsewhere, give the replacement fuse a handle made of cellophane tape. Place the new fuse in the center of a strip 2″ long, fold the tape up over, and put the adhesive sides together face to face, forming a tab. —*John A. Comstock, Wellsboro, Pa.*

▶▶▶SHORT of galvanized screws to attach an aluminum threshold, I used a propane torch to coat the head of a steel screw with solder, after it was in place. This was two years ago, and though the galvanized screws have rusted out, the improvised one is as good as new.—*Stephen N. Stresnic, Fort Lauderdale, Fla.*

WHAT'S YOUR MECHANICAL IQ?

The Case of the Threading Cut

"I HAD just finished this threading cut on the lathe," said Jurgens, "when the lights went out. The crooks pulled the main switch to cut off the alarm."

Lieutenant Moore saw that the quick-change box was set to cut 11 threads per inch, a reasonable count for those on the bar between centers.

"Isn't the motor circuit separate from the lights?" he asked, idly turning the threading dial with a finger.

"Sure, but I switched off the lathe just as they went out," Jurgens replied quickly. "Then, stumbling around in the dark to get to the switchboard, I heard the crooks smash into the cashier's cage, and get away."

The Lieutenant straightened.

"No, you didn't. Working overtime alone, you waited for a night the payroll

was in the office safe. You made this bar much earlier, stuck it in the lathe, switched off the alarm and broke into the cage yourself. Then you called headquarters, trying to make it look like an outside job. The money is probably still here."

How did the Lieutenant know?

See page 152 for the answer.

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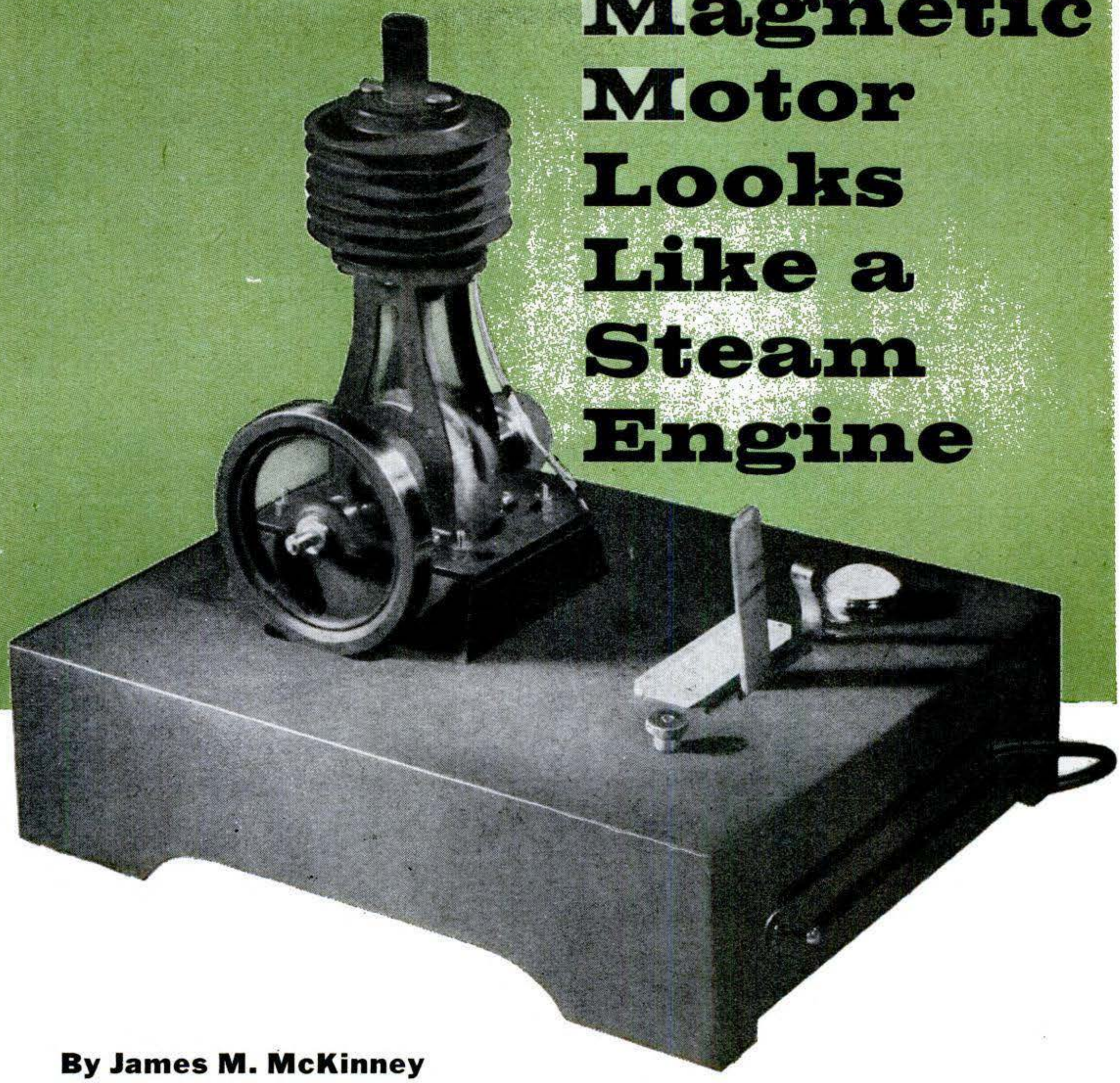
You'll find a happy combination of fine machining and electrical work in this challenging project

Magnetic Motor Looks Like a Steam Engine



By James M. McKinney

IF YOU like the flash, bob, and glitter of a model steam engine, this unusual project may be for you. The old-time steam flavor is what this engine produces—from magnetism.

The engine's cylinder is a solenoid, its piston a soft-iron core. The valves are breaker points, and the "steam" comes from pulses of household AC. The resulting twice-a-cycle magnetic field sets the engine spinning at 900 r.p.m.

This makes the engine a fine demonstration of electromagnetism. It's a sure-fire conversation piece for classroom or parlor. Flick the switch and you can see how clever the guy who built it is.

Building it is a pleasant exercise on the lathe and drill press. It's not complex, but it does call for nice alignment and minimum friction.

The base plate. For rigidity and flatness, use $\frac{3}{16}''$ steel or brass. Drill and file the crank clearance hole to shape. Then the plate can be used as a template for the wood engine mount. The tapped holes can be located later as other

CONTINUED

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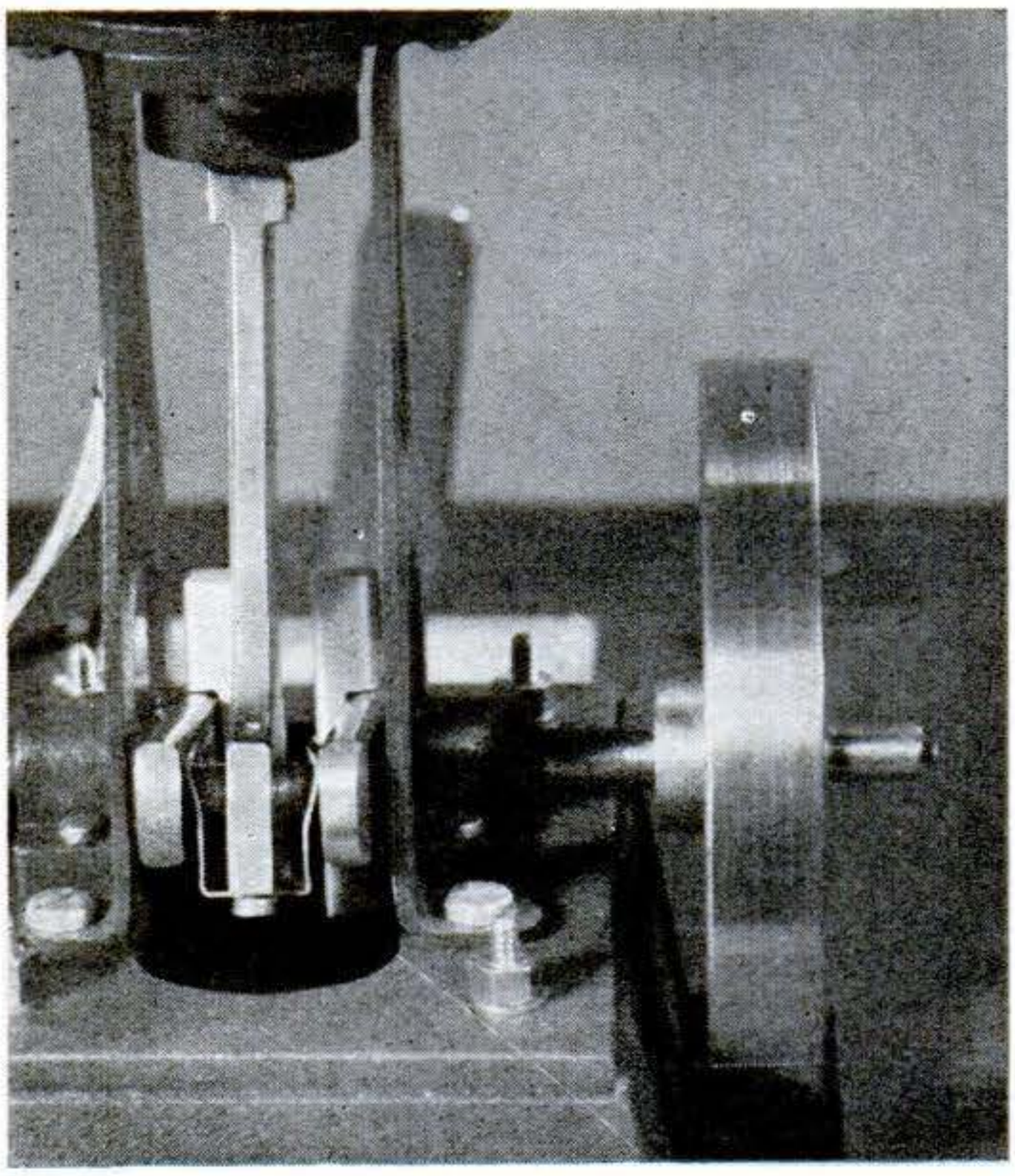
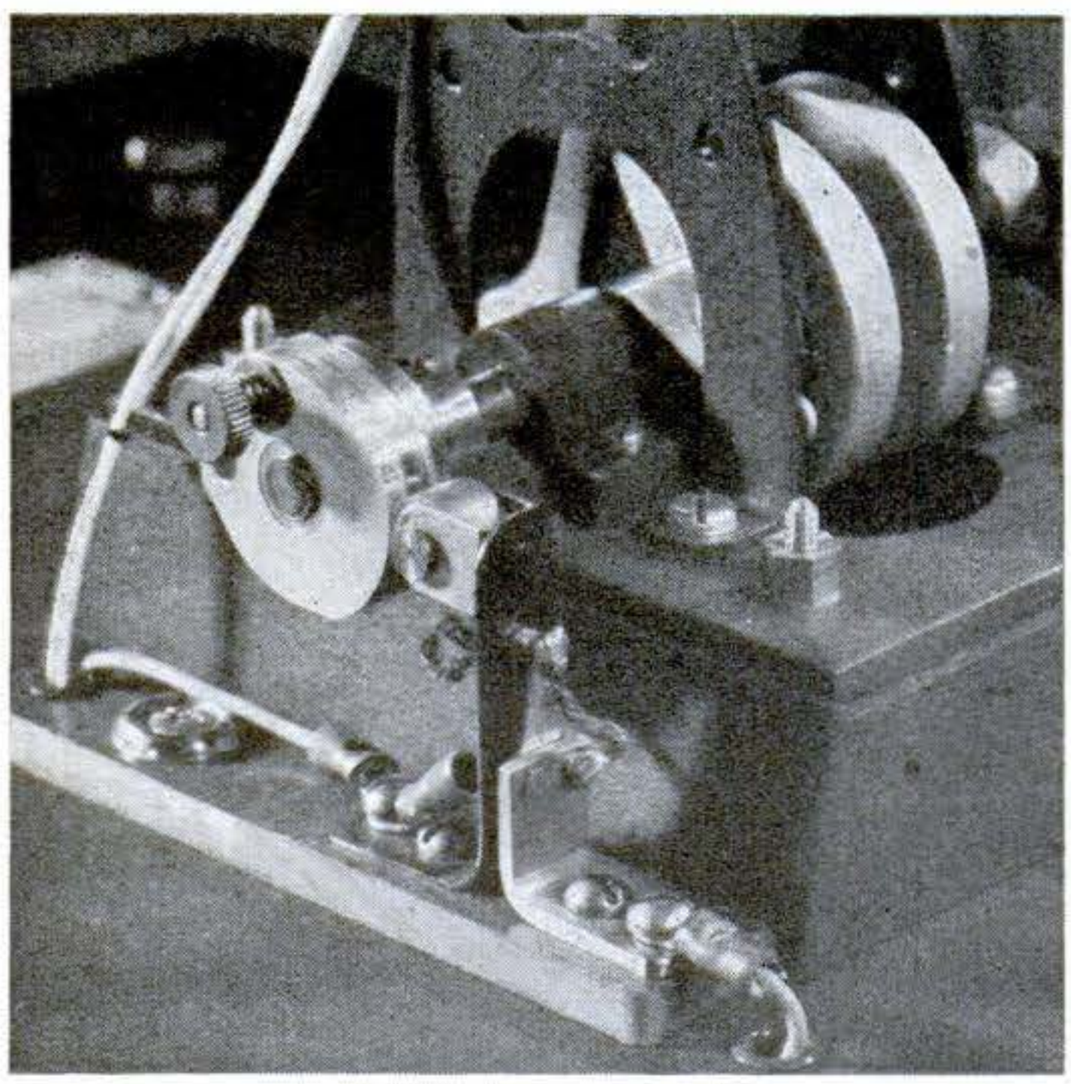
parts are completed and set in position.

Shape the bearings and bolt them in position on the plate before reaming the shaft holes. The 15/64″ drill can be used as alignment pilot. Mark the bearings to help make sure they're always reassembled in the same position.

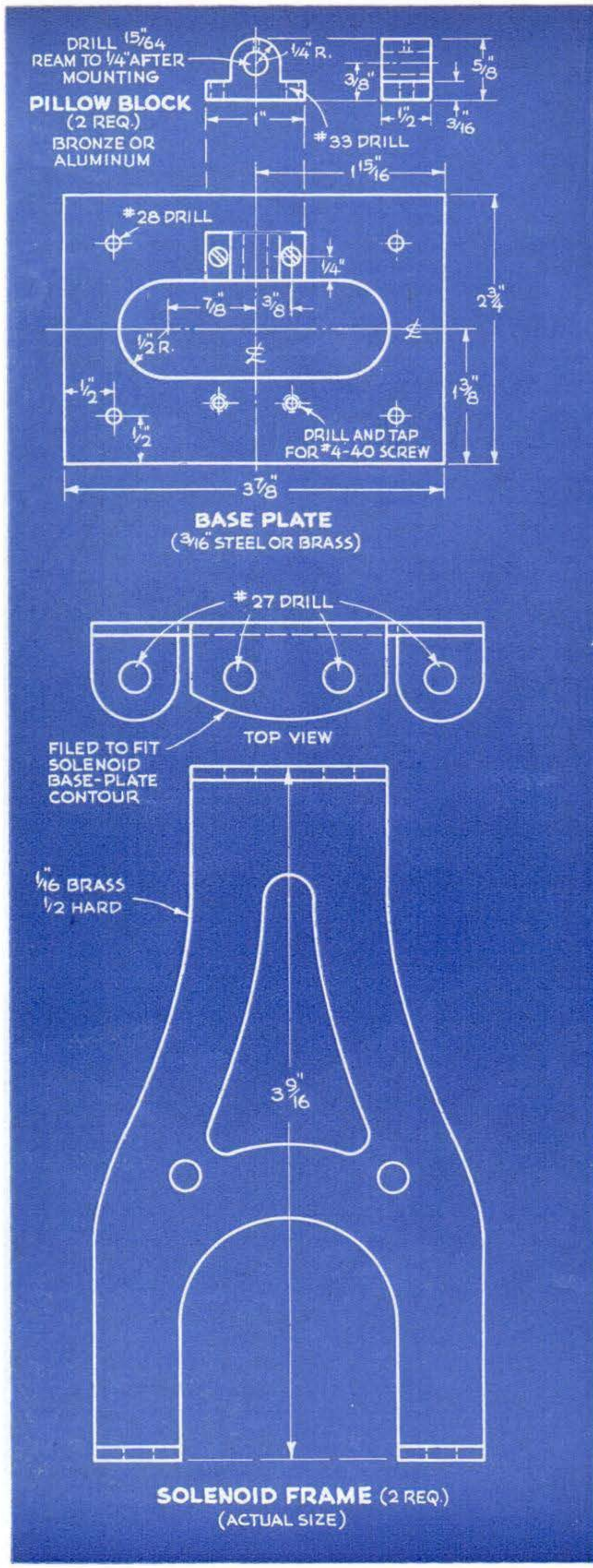
The crankshaft webs start as two pieces of steel bar. Or they could be



CENTERING CLIP ON CONNECTING ROD bears only lightly against the crank, could be eliminated by making the crank journal out of 5/16″ shaft, recessing the center to ¼″ diameter.



POINT ASSEMBLY IS ON SEPARATE BASE for easy positioning. Cam lobe should push points shut, flex short spring for sliding contact. Elongated holes in bracket allow fine adjustment.



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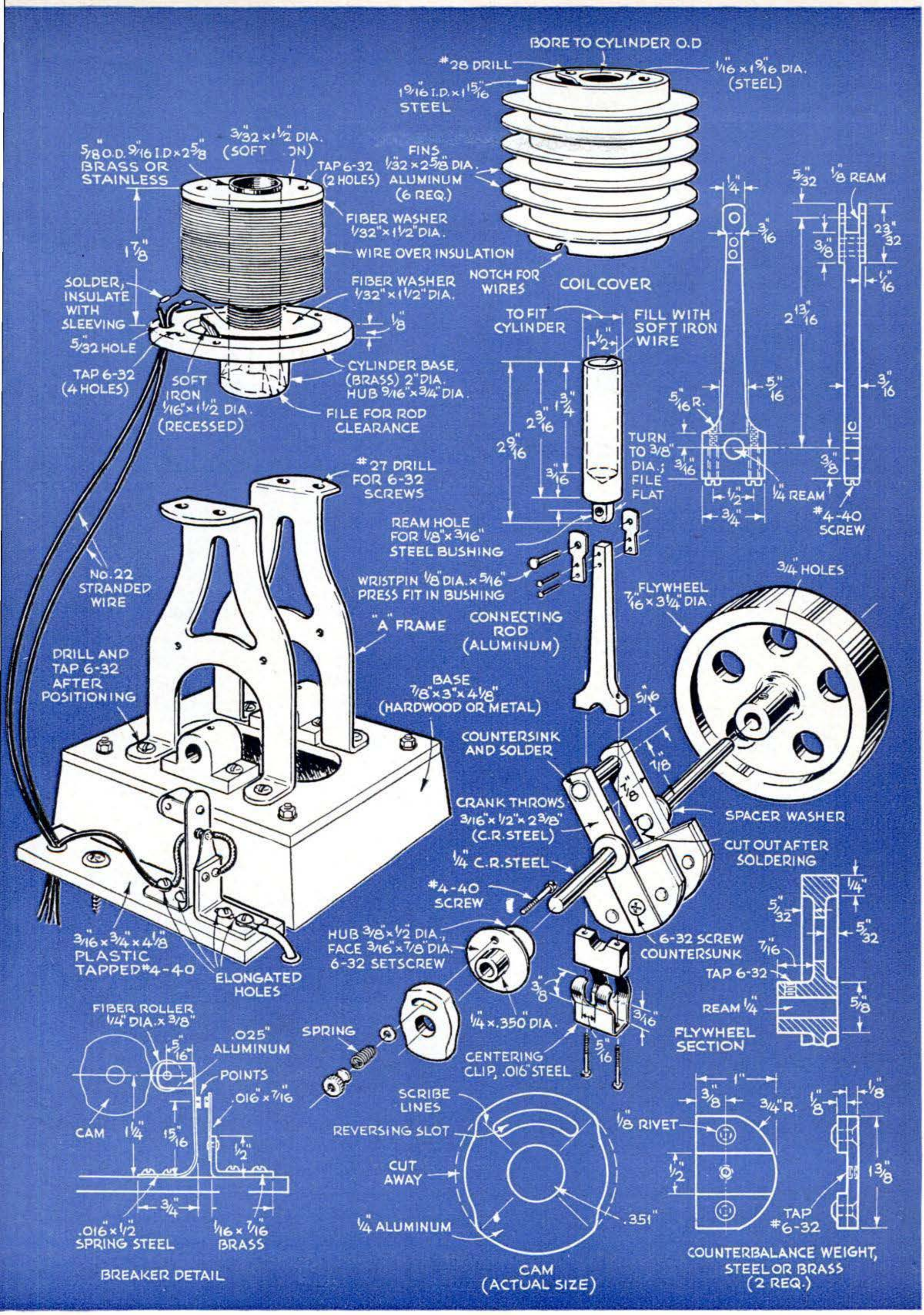

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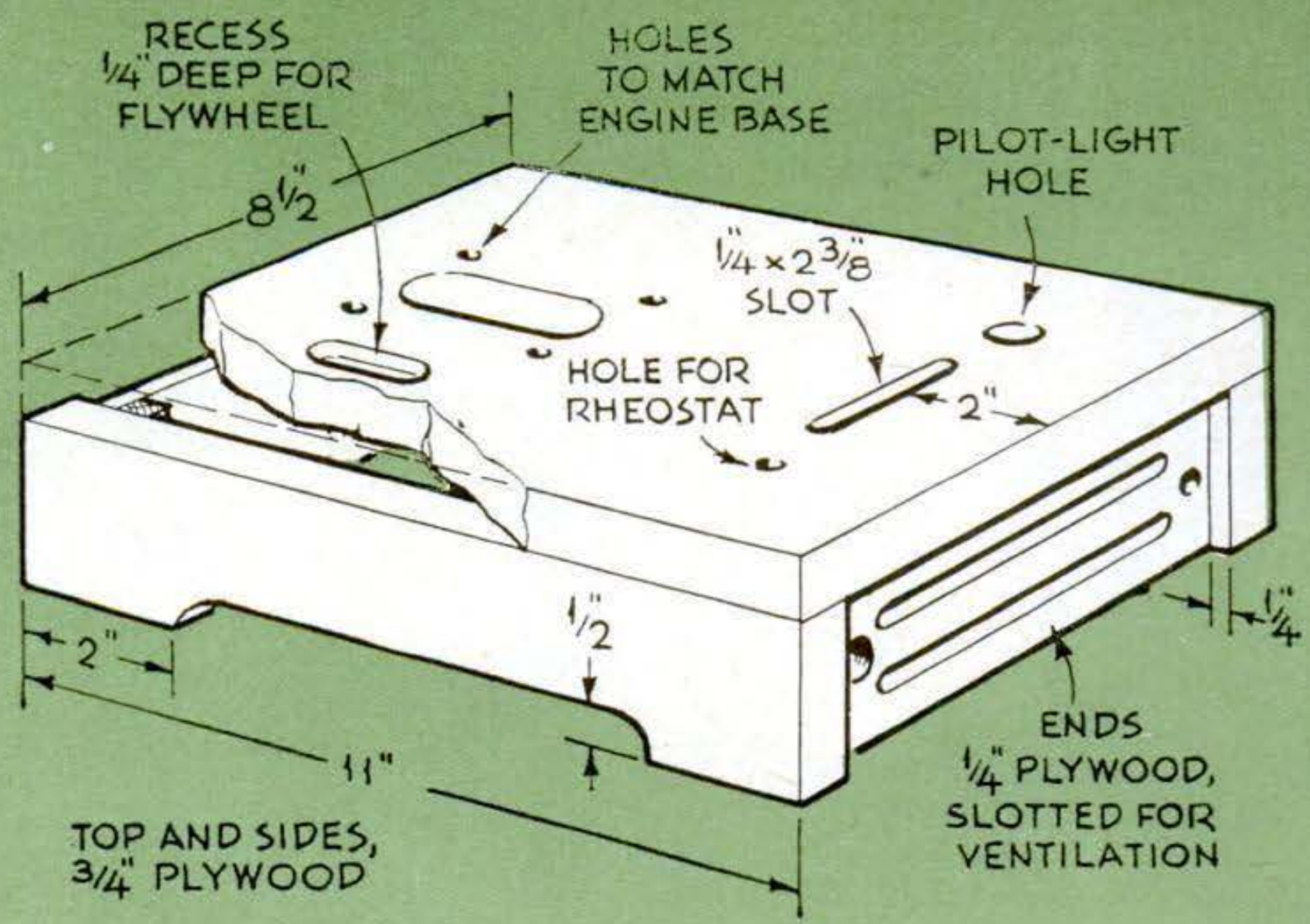
"Boilerworks" are electric

WIRING MAIN BASE can be done easiest before engine is mounted; all parts except points and coil go on underside. Clearance holes for crank and flywheel can be located by positioning engine. Use #22 stranded hookup wire for electrical work; any low-wattage pilot can be used, other parts must be able to handle 50-75 watts. Capacitor from old electric motor can be used, and potentiometer can replace rheostat. Use flat black paint.



filed to shape from 1/4" flat stock, which would eliminate adding counterweights.

Clamp the parts together before drilling and reaming. Press in the main shaft (made of cold-rolled steel or drill rod) and then the crank-throw journal. Solder the parts together before cutting out the main shaft's center. Then chuck the assembly; if it spins slowly without runout, it's finished.

The connecting rod is 3/16" flat aluminum. Drill and tap the end of the blank before cutting off the cap. Then smooth the cut and screw the cap back in place. When the 1/4" shaft hole is drilled and reamed, mark cap and rod for identical replacement.

Riveting 1/16" flat stock to the upper end saves filing a piston slot. Drill the 1/8" wristpin hole; this will be a press fit for the pin. If the spacing between wristpin and shaft holes checks out, file the rod to shape. Be sure to check the spacing first; it's heartbreaking to find you've filed a misdrilled rod.

The engine's "A" frames must have parallel and true 90-degree bends. Access to a bending brake is handy here. But the bends can be made with a vise.

Check the bends' accuracy before filing the blanks to shape. Shims can correct minor misalignments, but the finished frames won't take rebending. Bolt the bent blanks together and stand them on a flat surface for a once-over from square or height gauge.

The flywheel is a straightforward lathe job. Painting the drilled web black will improve its appearance in motion.

Or root in a war-surplus shop for a right-size spoked gear. Mount on a stub mandrel, turn off the teeth, and press on a "tire" cut from a pipe coupling. Face off the assembly and you'll have a particularly handsome flywheel.

The piston and wristpin are more sophisticated lathework. Drill out the 5/8" 17ST or 24ST aluminum bar. Without removing it from the chuck, fill the hole with a low-melting alloy. (You can un-

How to Get a Machinist's Blueprint

RATHER work from a separate sheet of drawings in building the little magnetic engine? You can. The editors have made available a real blueprint with all parts shown in plan and elevation. How do you get it?

Send $1 to: **MAGNETIC ENGINE PLANS**
Popular Science Monthly
355 Lexington Ave.
New York 17, N. Y.

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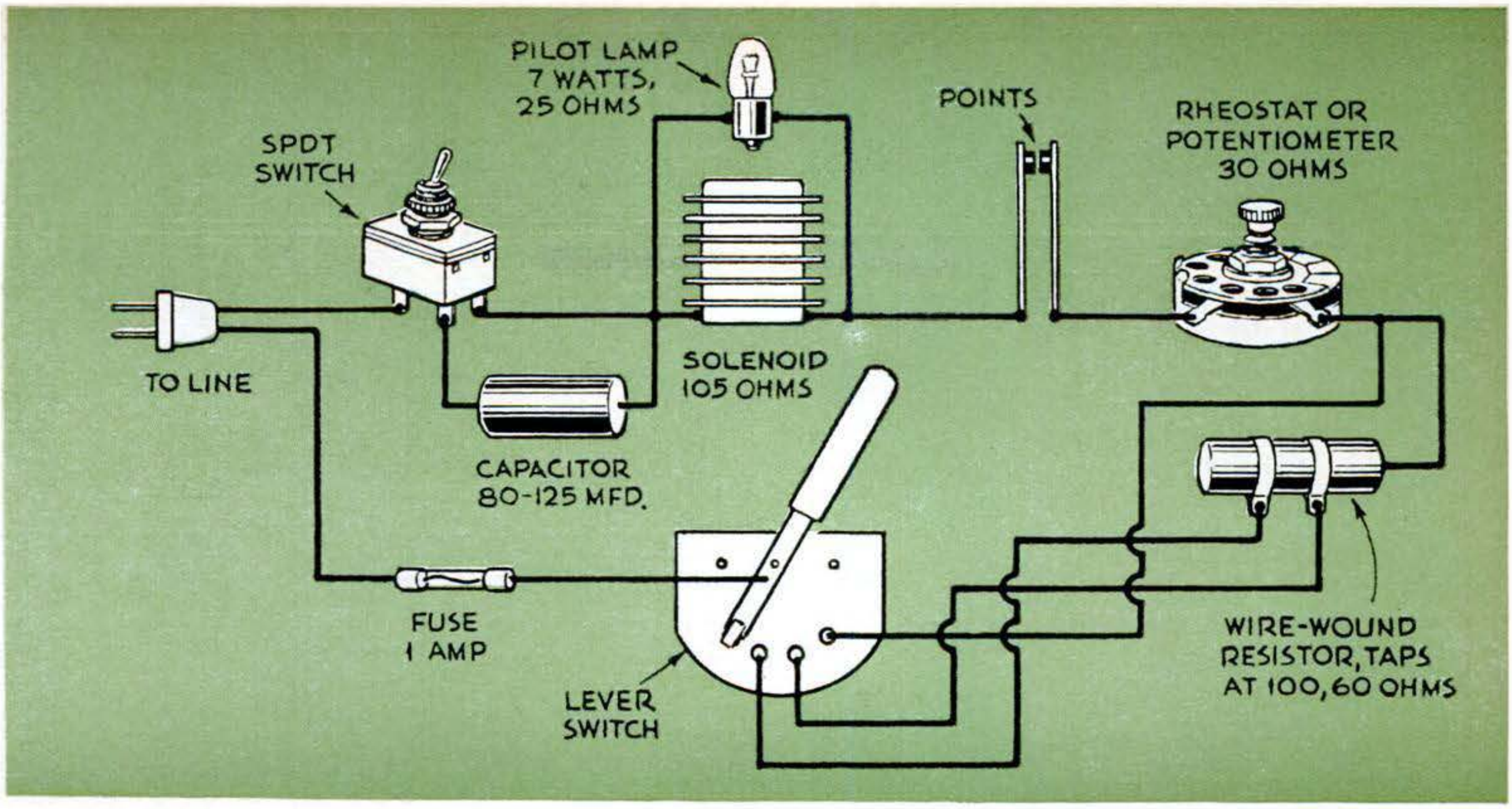


screw the chuck from the headstock for convenience.) Use ordinary solder if Woods Metal or Tuballoy aren't handy. This metal supports the thin wall during the rest of the machining.

After finishing the outside of the piston, reverse it in the chuck. Then turn the bottom end to 3/8″. Drill and ream the $\frac{3}{16}$″ hole, and file this narrow end flat to fit the connecting rod.

The piston can be coated with colloidal graphite to further reduce friction. Spray it on, and bake the piston for a half-hour at 325 to 350 degrees. This will give a coating .0015″ to .002″ thick.

Pack the piston with soft-iron wires. You can scrounge these from an old six-volt ignition coil. Cement the wires in place after you have filed or ground them flush with the top of the piston.

The wristpin can be lathe-turned or 1/8″ round stock. It's pressed in the $\frac{3}{16}$″ bushing to increase bearing area. The piston turns on this bushing, not on the wristpin.

Rolling the wristpin between two files can knurl it enough for a tight fit.

The solenoid cylinder is made of brass tubing of $\frac{9}{16}$″ inside diameter. Stainless steel, also nonmagnetic, could be used.

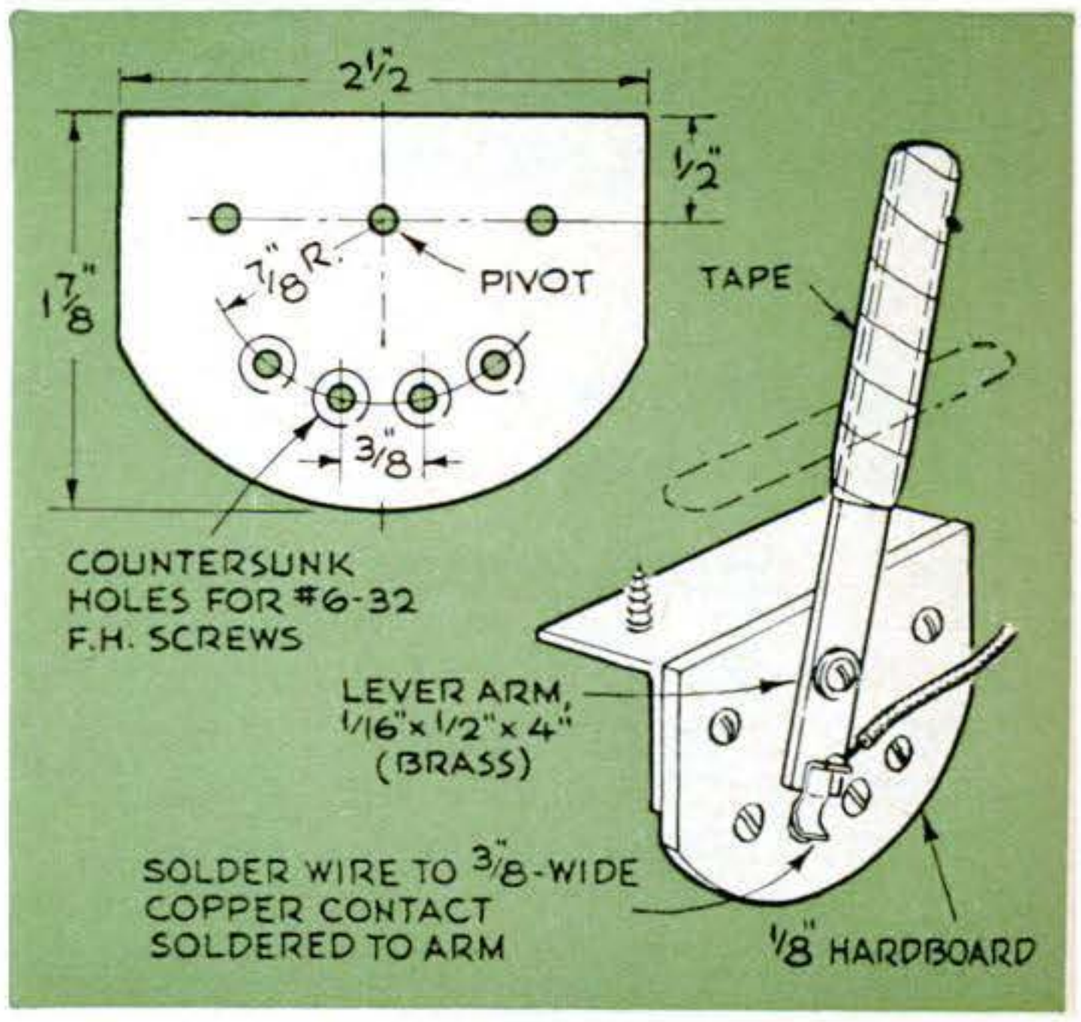
The bore of a brass cylinder should be chrome-plated. This means the cylinder must be soldered to the base and filed for connecting-rod clearance before plating. The piston should be a free fit for the cylinder—.004″ to .005″ clearance.

Slip the bottom iron and two fiber washers over the cylinder before soldering the top iron washer in place. If soft iron isn't available, you can use steel.

The outside of the brass cylinder must be insulated—use tape, varnish, or plastic. Keep this insulation thin to reduce the air gap between coil and core.

Mount the cylinder assembly on a $\frac{9}{16}$″ lathe mandrel to wind the coil. This will take a half-pound spool of No. 30 en-

[*Continued on page 234*]



LEVER SWITCH to control speed mounts on 1″x1″ angle bracket. A commercial single-pole, four-position rotary switch may be substituted; the knob can match the one on the rheostat.

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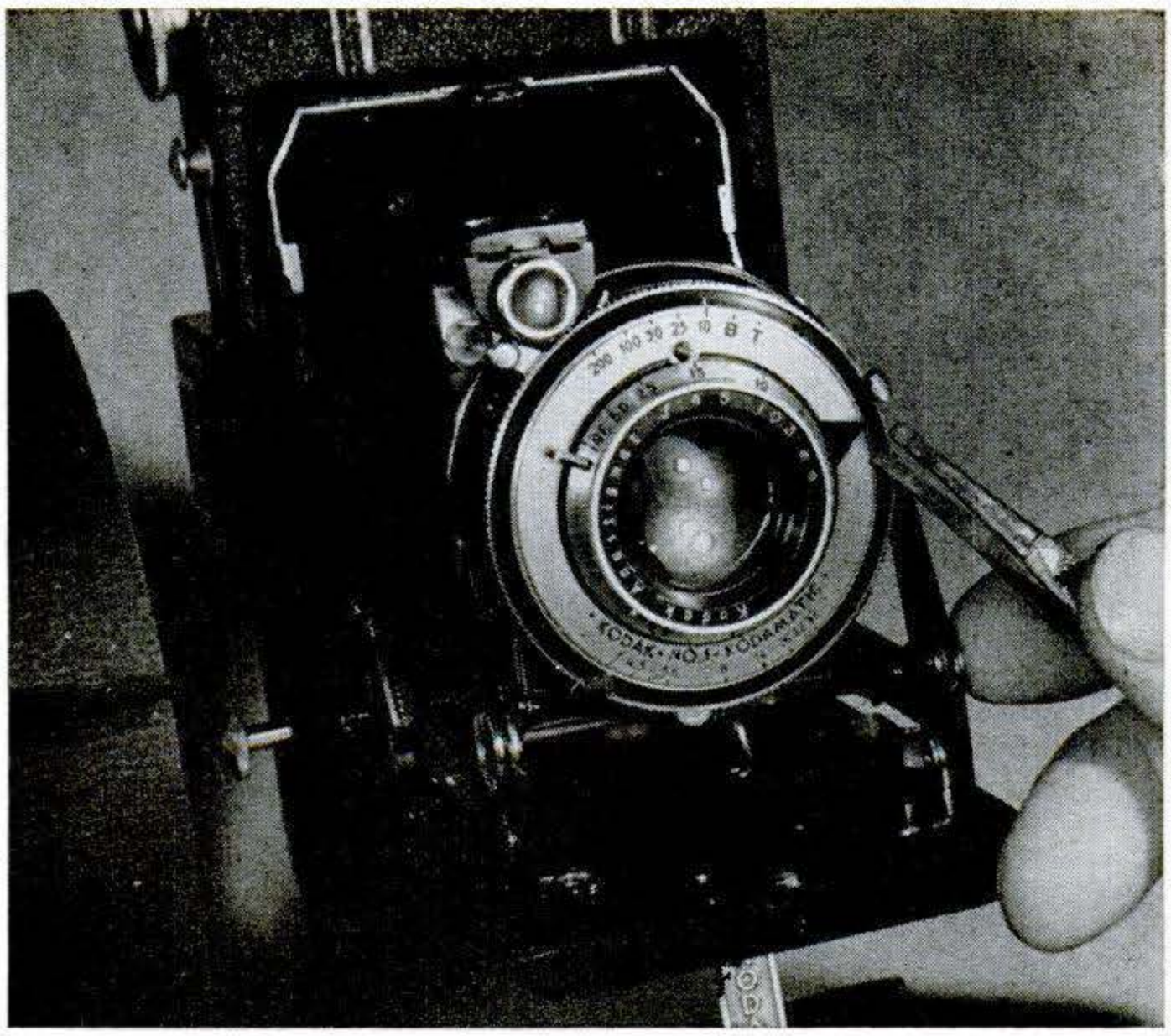
Short Cuts and Tips

FROM PS READERS

Self-Timer Warning Tab

IF YOU'RE not in the picture when a camera self-timer lever reaches the exposure point, you've wasted film.

By pasting an arrow of masking tape ahead of the tripper point on the shutter, you'll be able to see when the photo is about to be snapped.—*K. Meredith, Grand Rapids.*



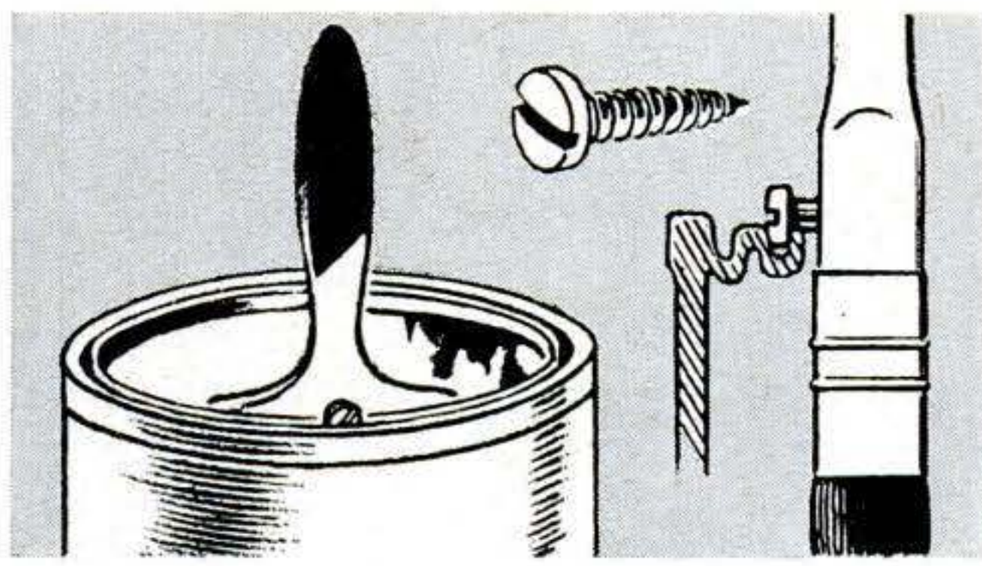
How to Improvise Bags for Cleaner

REPLACEMENT bags for canister-type cleaners can be made from grocery sacks.

Cut out a stiff plate from corrugated board to hold the bag in place. Shape it as shown at left and glue it to the bottom of the sack. Cut a slit to admit the dust, trim the sack to the proper length to fit in the cleaner, and glue the top shut or seal it with tape.—*D. C. Marshall, Manhattan, Kan.*

Solution to the Case of the Threading Cut (See page 146)

IF JURGENS had just finished a threading cut, the threading dial would have been engaged with the lead screw, and the Lieutenant could not have turned it with a finger. In his haste to get on with the robbery, Jurgens had forgotten to engage the dial gear—something he could not have overlooked when actually cutting an odd-numbered thread.



Hanging a Brush in a Can

TO HANG a paintbrush inside a can of paint or solvent, drive a sheet-metal screw into the handle. The screwhead will catch on the inner lip of the can. —*Norm Jacky, Seattle, Wash.*

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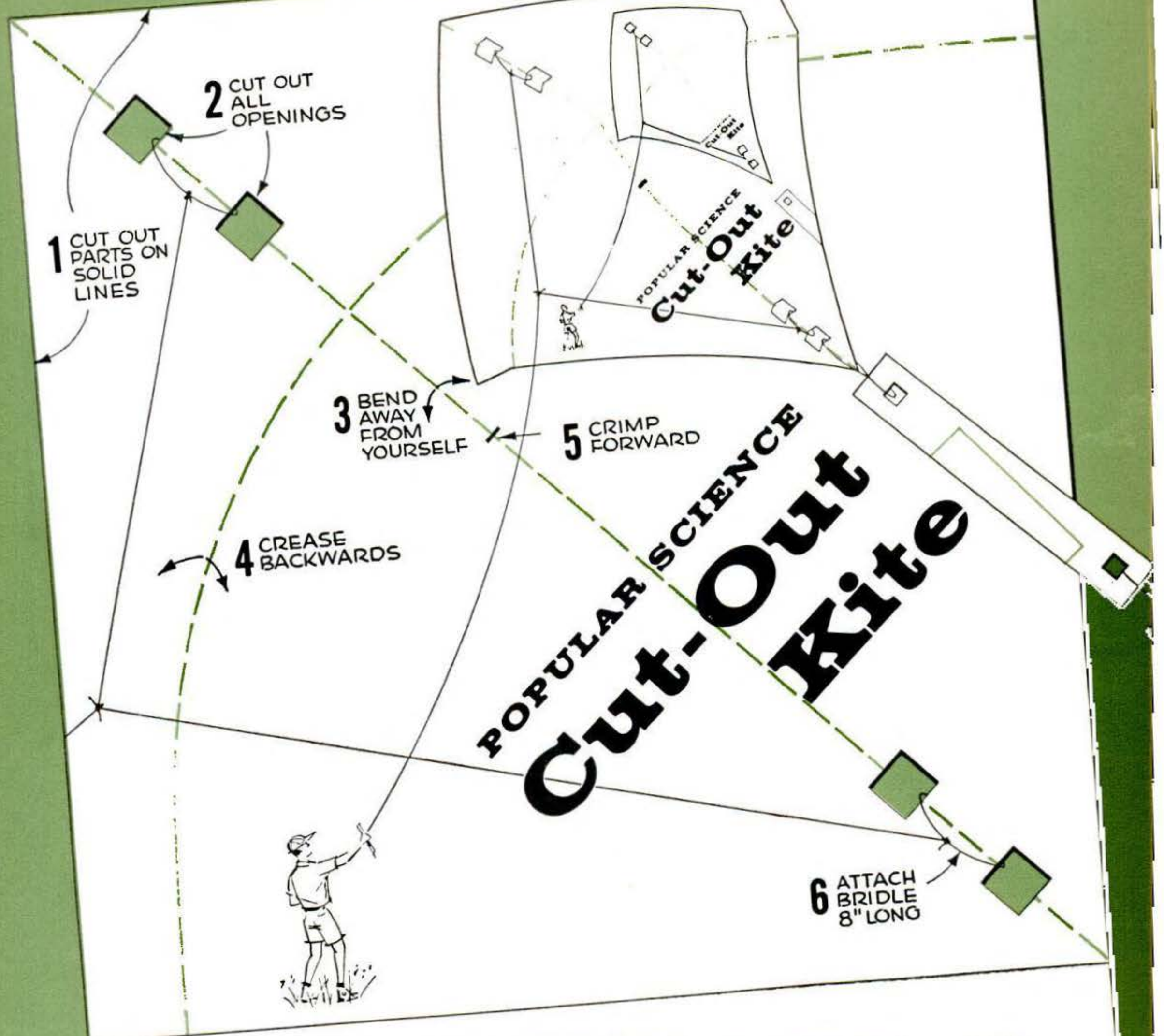

7 ATTACH TAIL PARTS WITH 1" SPACING

How to Cut and Fold the PS Kite

THIS KITE will fly indoors if towed at a brisk walk. Make it by cutting along the black lines, folding on the broken green ones. You'll have to cut through these instructions to make the tail—or transfer the pattern to another sheet by tracing over carbon paper. Crimp the kite's "spine" where shown. Tie the main thread about one-third the way down from the top of the 8″ bridle (you may need to change this spacing). Tie on the tail pieces an inch apart, and you're done.—*Frank Shore.*

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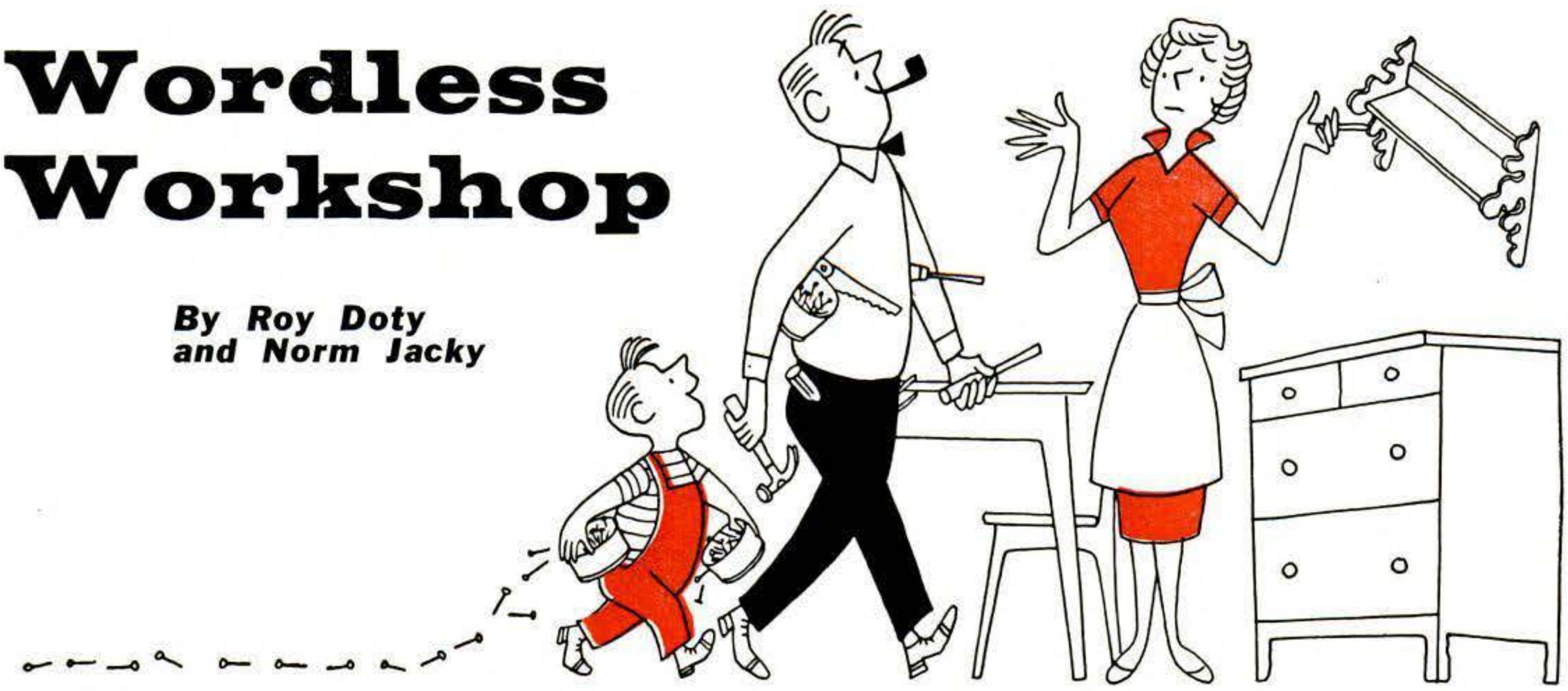
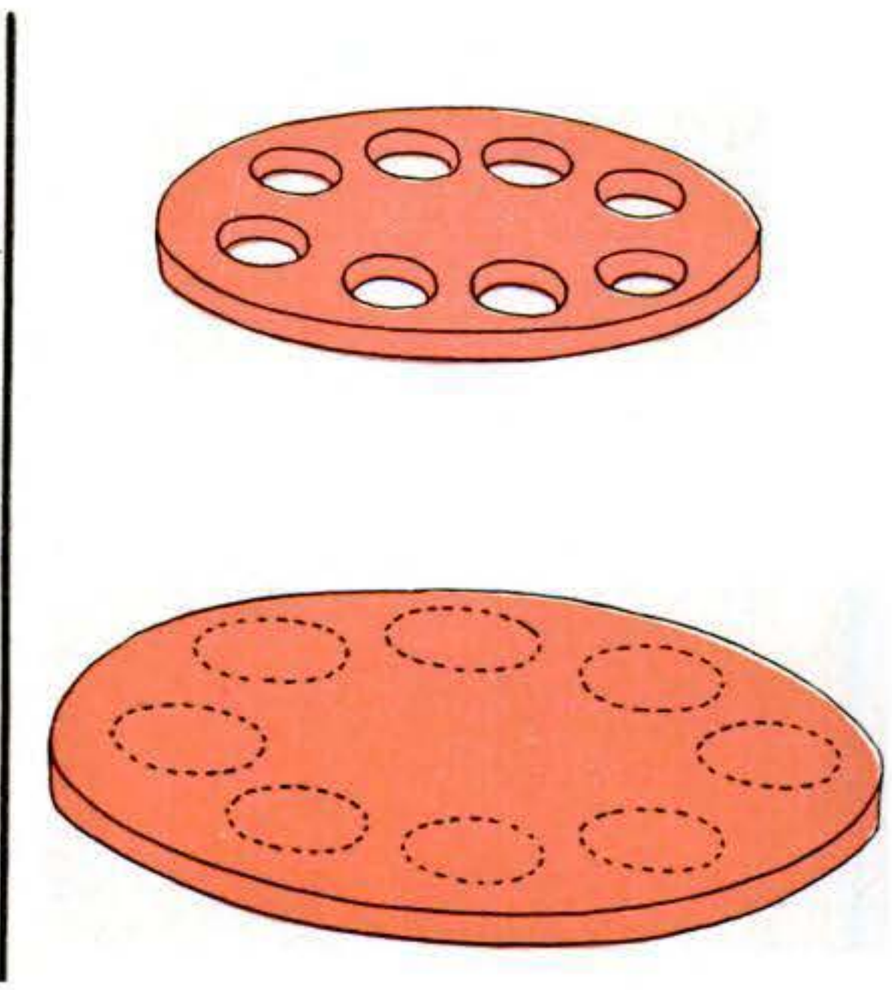
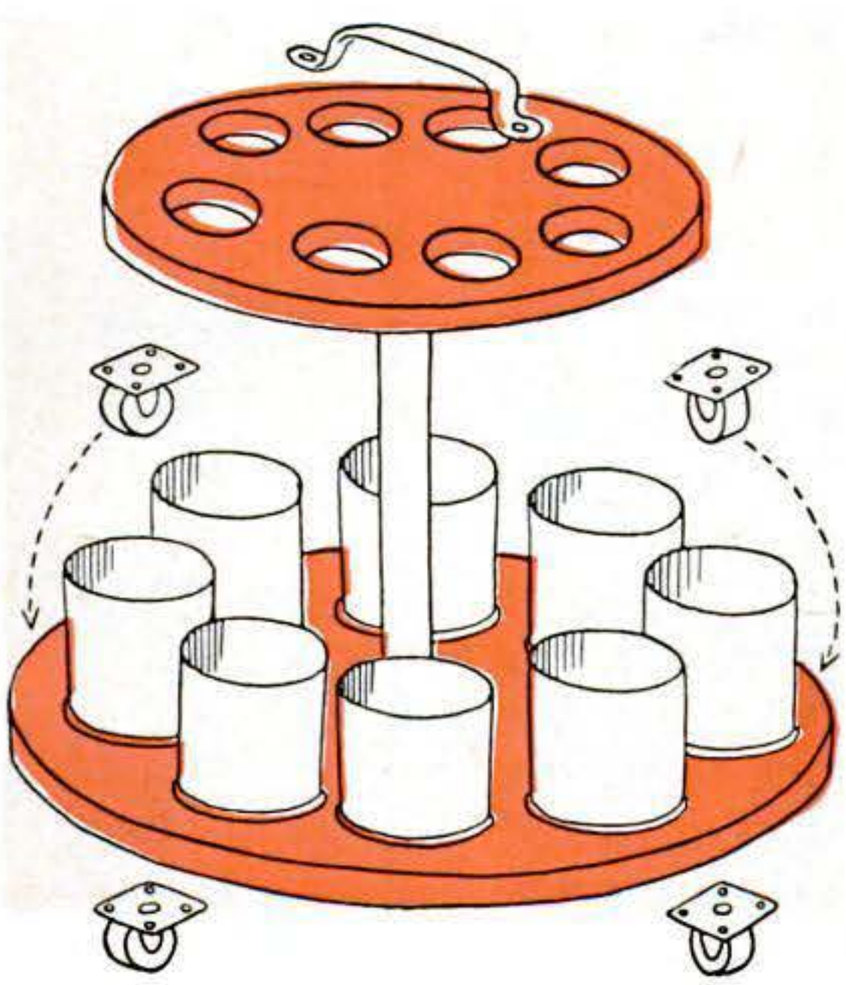
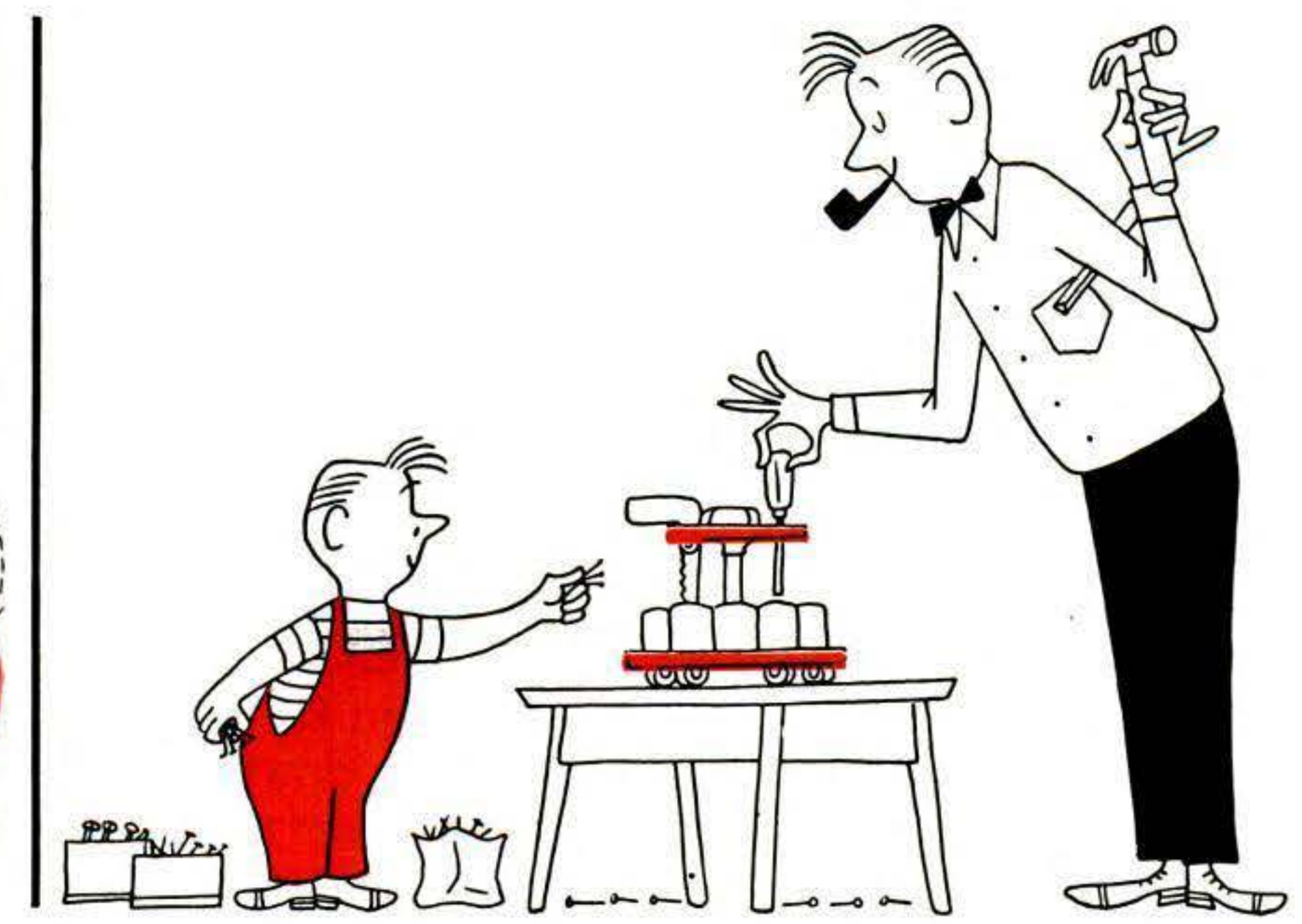
Wordless Workshop

By Roy Doty
and Norm Jacky









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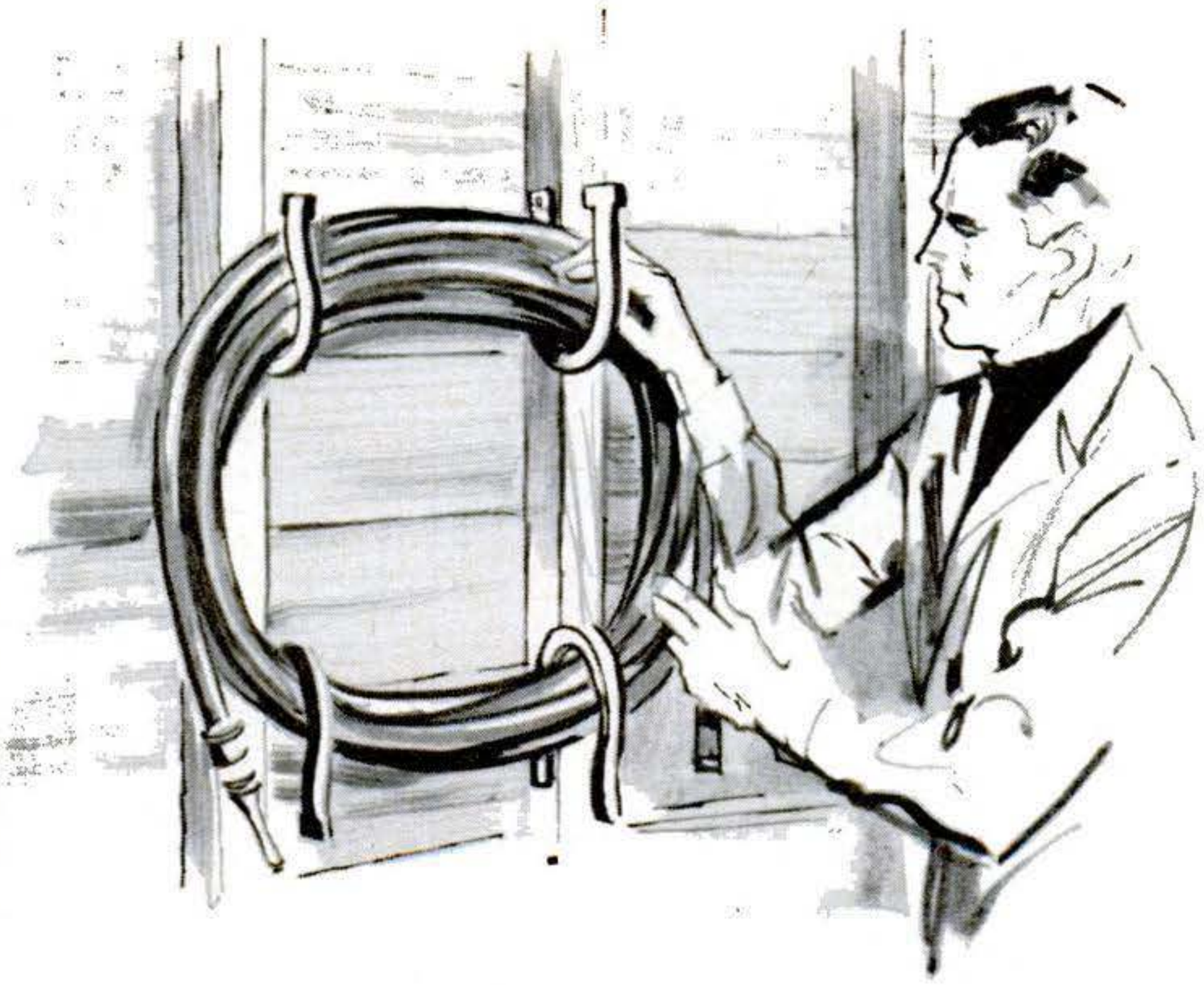
Short Cuts and Tips

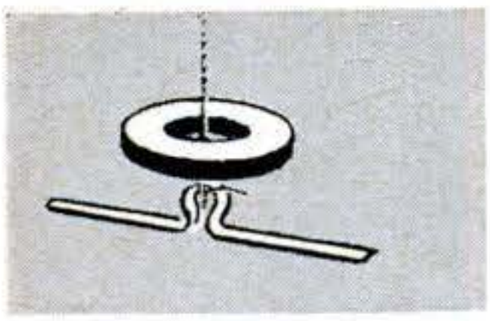
FROM PS READERS

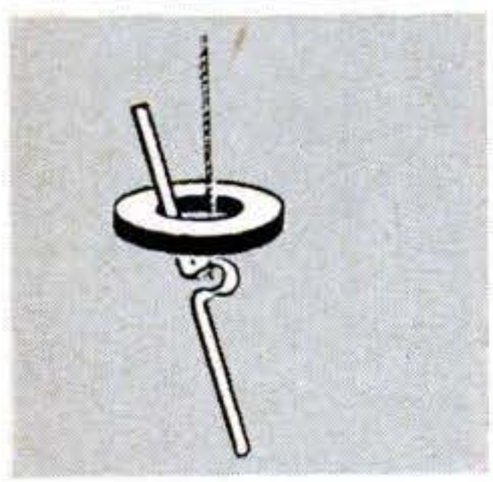


Rubber Horseshoes Support Hose

Two pairs of hard-rubber playing horseshoes nailed to the studding in a garage or tool shed make a fine rack for storing garden hose. Install the top ones with the open ends up, the lower ones with the ends down as in the sketch at right.—*Vincent H. Lamson, Utica, N. Y.*

Dispenser for Washers

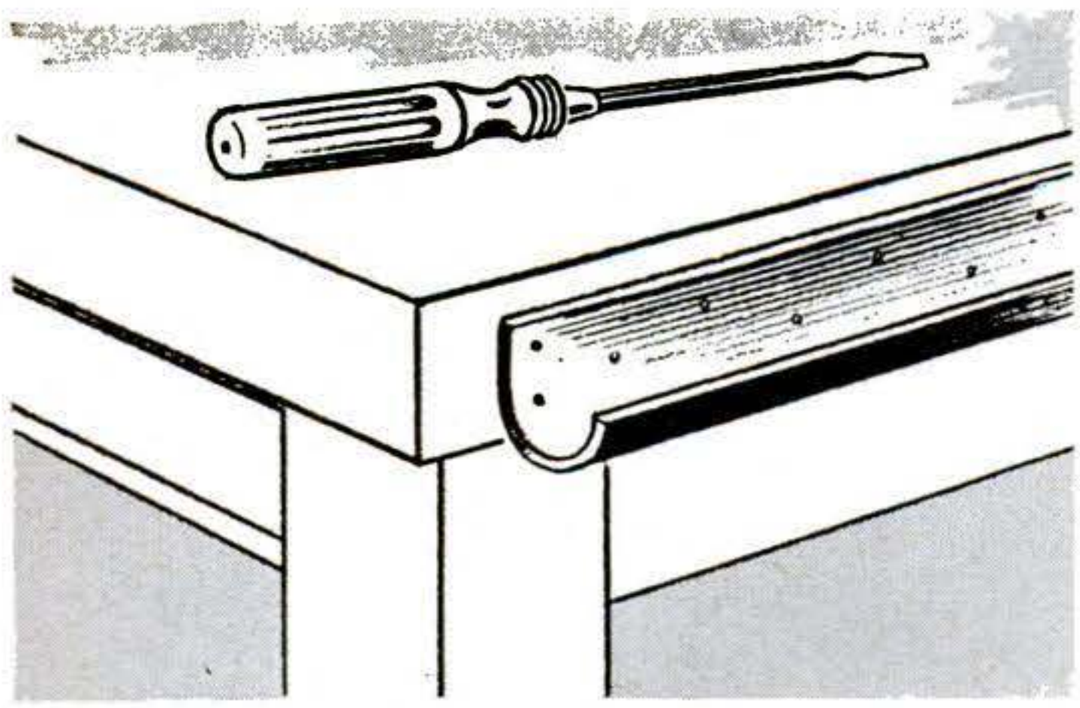




A COTTER pin and a length of string hung near your workbench make a handy dispenser for washers. The cotter pin is bent open and the string tied through the loop. Turning the pin lets a washer slip over it right into your hand.—*John Mihalick, East Liverpool, Ohio.*

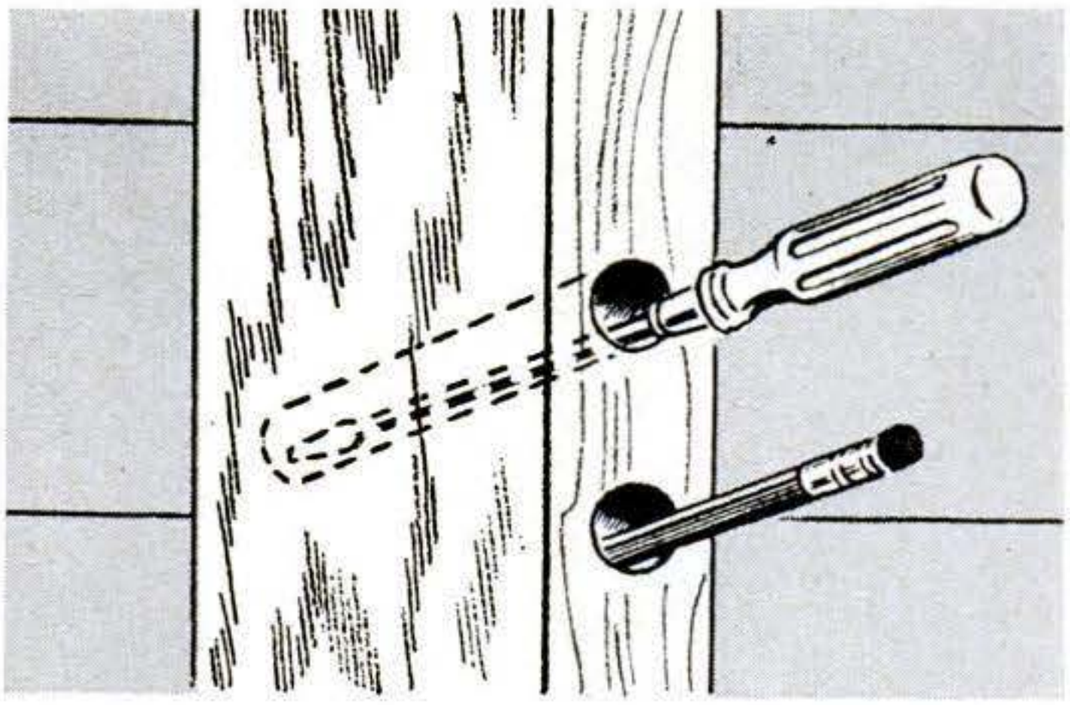
Tags for Identifying Wires

WHEN several wires or cables run in raceways or terminate a distance away from their point of origin, as in some hi-fi systems, key tags are a handy way of identifying them. The tags can be bought in any stationery store, come in various sizes, carry their own attaching wire.—*Hartwell W. Hughes, Inglewood, Cal.*



Gutter for a Workbench

A TROUGH along the edge of my workbench serves as a catch-all for tools and small parts that roll off the top. I made the trough from a piece of discarded 1½″ hose, slit down the center and attached to the bench with flathead wood screws.—*F. Murray, Chicago.*



Tool-Storage Holes in Studs

IN A SMALL workshop, holes drilled into studs at a 45-degree angle provide handy storage for screwdrivers, pencils, and other small tools. A precaution: Drilling holes too large in diameter or spaced too closely may weaken the stud. —*Jack Norman, Portland, Ore.*

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The camouflage is perfect, the photos really candid. Here's how I hide a—

Camera in a Cigarette Pack

By Phil McCafferty

PUTTING a false face on a subminiature camera gives you a brand-new kind of picture-taking fun. Since no one can tell what you're doing, you can catch people—especially kids—in odd and humorous poses. You get unrehearsed action instead of the grimness of posed pictures. And if you're like me, you know that the best shots always happen when you don't have a camera with you. With a subminiature, you can have one with you all the time.

The cameras can be bought for as little as $20, as much as $400. Many have all the refinements of expensive large cameras: fast shutter speeds, double-exposure prevention, and film counters. One model I looked at was shaped like a fountain pen. Another could have been made to fit on the wrist like a watch. Another

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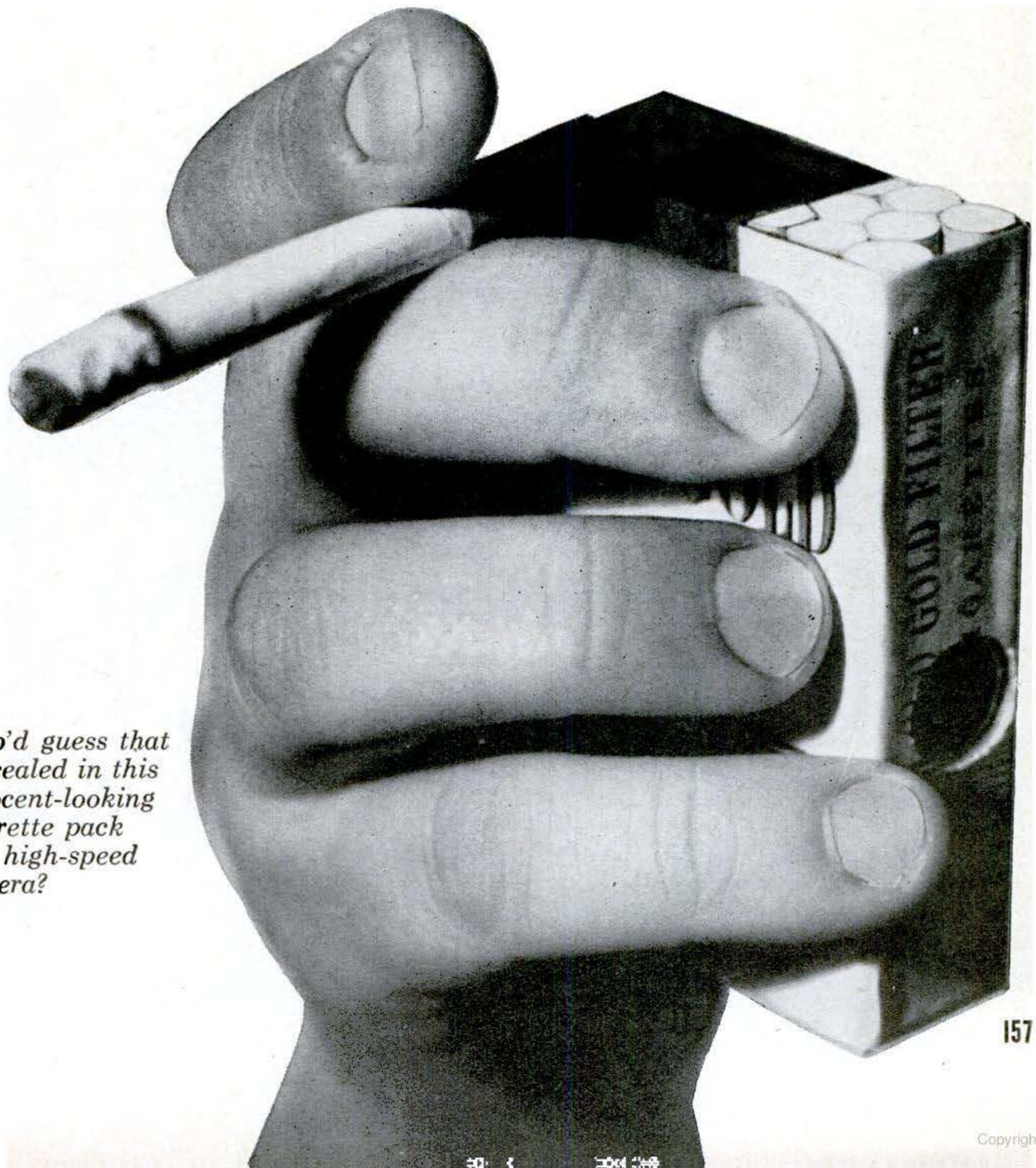

Who'd guess that concealed in this innocent-looking cigarette pack is a high-speed camera?

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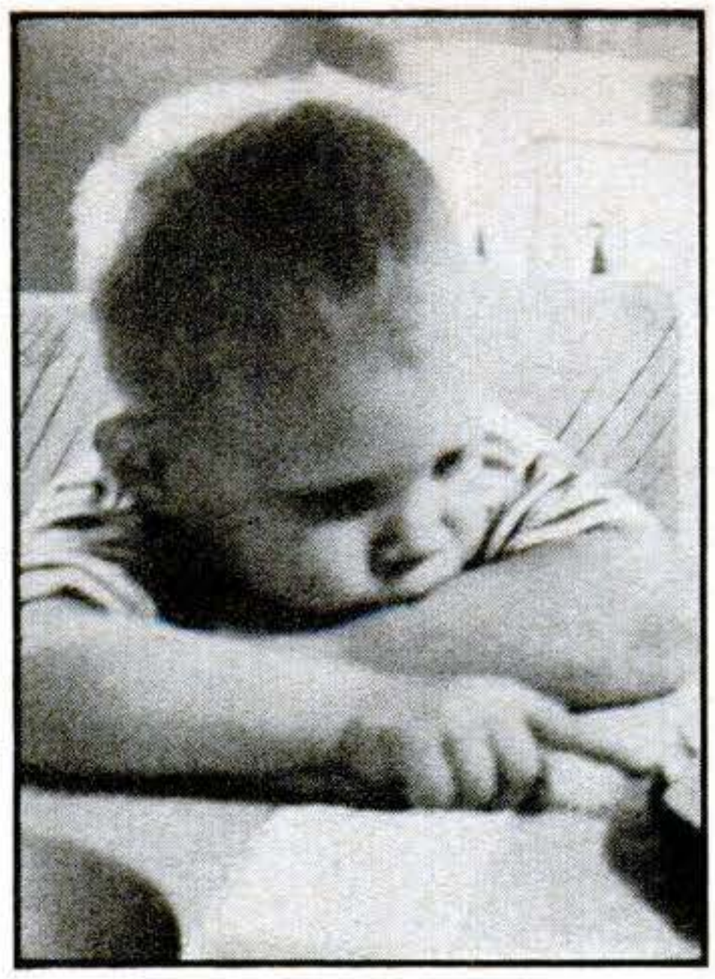
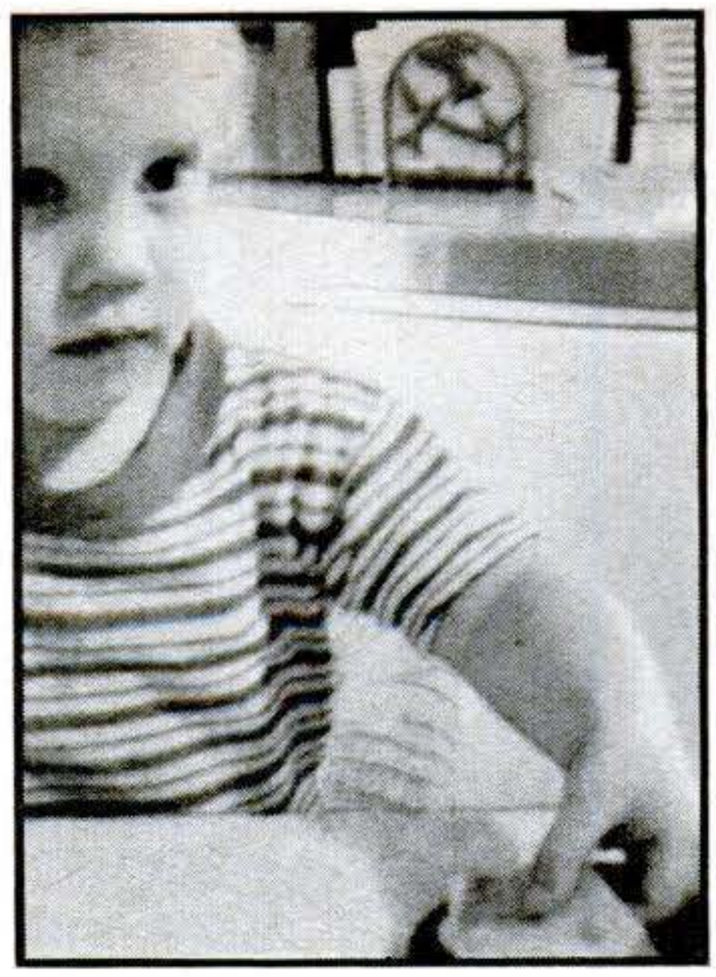
How a hidden camera showed up a cookie delinquent



I'll just sneak one little touch.



Why not grab? Nobody's looking.

would have fitted into a candy-bar wrapper.

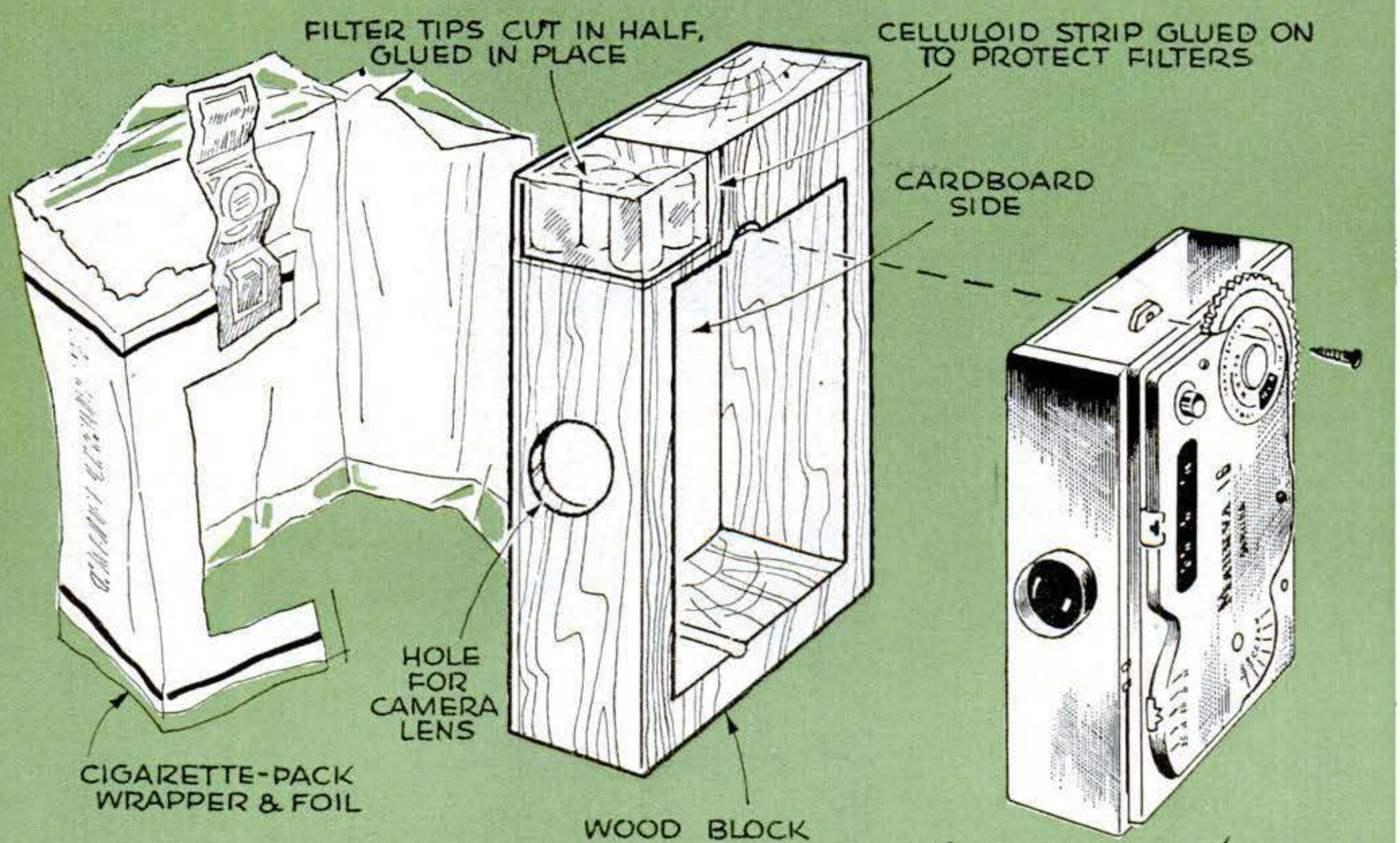
I finally settled on a Japanese-made Mamiya, which takes 16-mm. film and sells for about $40. It's a perfect fit for a dummy pack of cigarettes that I made.

I soon learned that you don't snap subminiature pictures with the ease of a TV spy. You have to hold the camera very steady as the shutter is snapped, or movement will spoil the picture.

After a few trial exposures, I learned to estimate the area the camera lens would cover. This eliminated the use of the viewfinder, a dead give-away.

The lenses on these tiny cameras are so fast you need very little light. Using medium-speed Plus-X film, and rating it at ASA 160, I got fine indoor shots without flash, shooting at f/3.5 and 1/25 second. With faster Tri-X film, I could shoot at 1/50 second and f/4.5.

Outdoors in the sun, Plus-X lets you shoot at 1/200 and f/11. Because of the extremely short focal length of the lens, focusing at all but very short distances is not critical. You just sneak up, snap the shutter, and no one knows it.



DUMMY CIGARETTE PACK consists of wood block cut to fit inside a regular wrapper, then hollowed out to take tiny 16-mm. Mamiya camera. One side of pack is left open for access to controls. Several coats of lacquer give appearance of cellophane wrapper.

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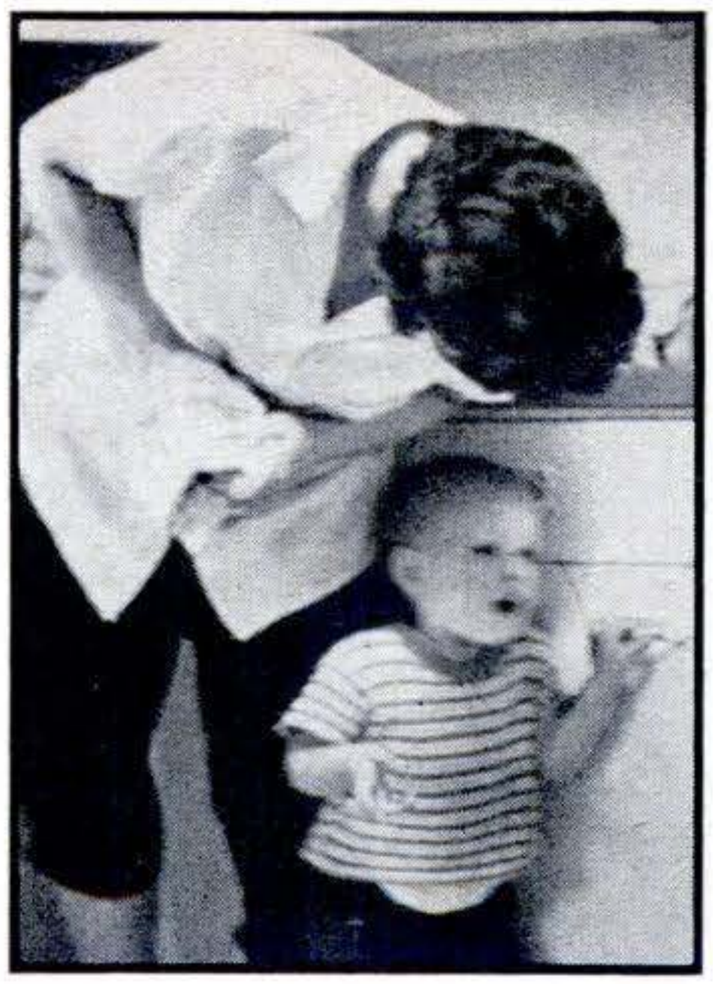
Oh, oh—caught in the act.



Wow, Mommy can sure get mad!

Whew, I was lucky to get out of that.

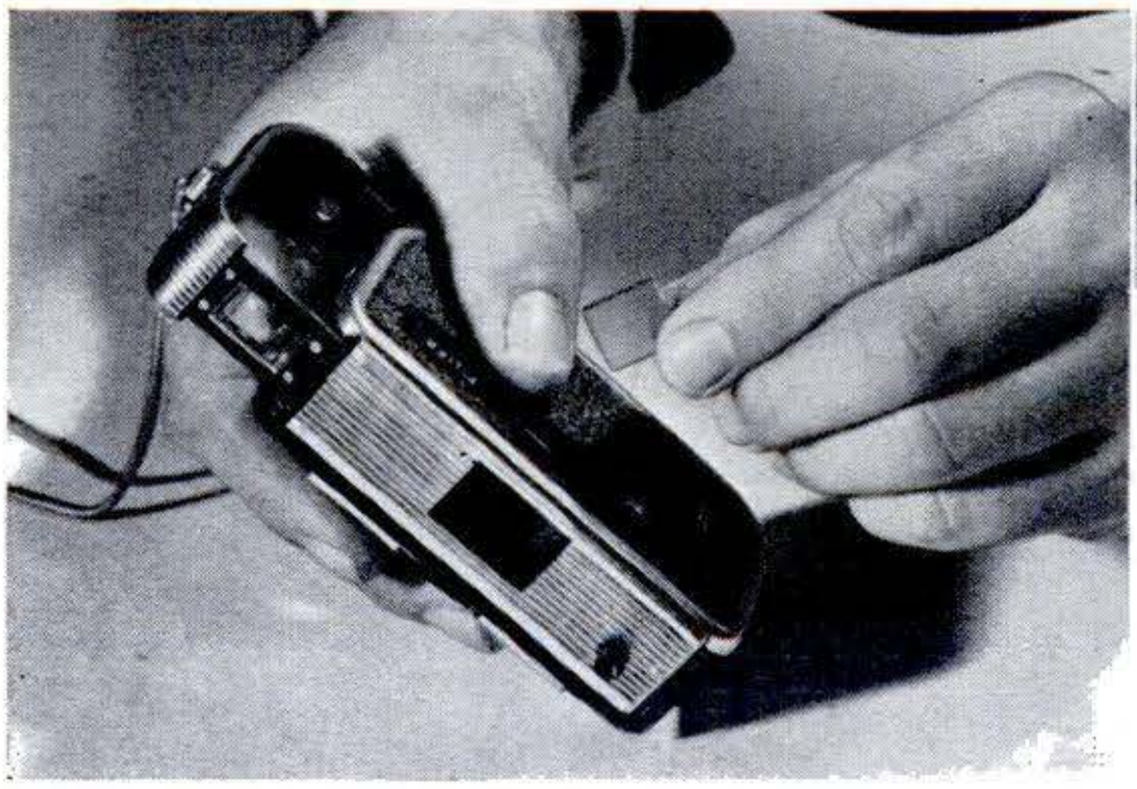
New Tiny Camera Stores Its Own Viewfinder and Filters

THIS new pocket-sized 16-mm. subminiature camera gets its compactness from a retractable viewfinder that slides into the housing when it's not in use. The slide also keeps you from accidentally tripping the shutter while the camera is in your pocket—it won't fire until the viewfinder is pulled out.

Want to use a filter? Instead of fitting bulky conventional filters on the outside of the camera, you have a choice of seven midget glass squares that slip into a slot in front of the lens. Taking up no space, they can be left on when you put the camera away.

One of the latest subminiatures to hit the market, the German-made import is called the MEC 16. An ingenious system of slide mounts converts tiny half-inch color transparencies so you can show them in any ordinary 35-mm. projector. The camera has a 20-mm., f/2.8 lens with speeds up to 1/1,000 second. It sells for $64.50 from Standard Camera Corp., 319 Fifth Ave., NYC 16.

FIT FOR A POCKET, MEC 16 is only slightly larger than a pack of cigarettes, weighs eight ounces. With the top closed, the shutter is locked against accidental release, and a sliding metal shield protects the lens.



FILTERS SLIDE INTO SLOT in side of camera and are locked in. Seven types of optical-glass filters, at $1.75 each, are available for use with color and black-and-white film.

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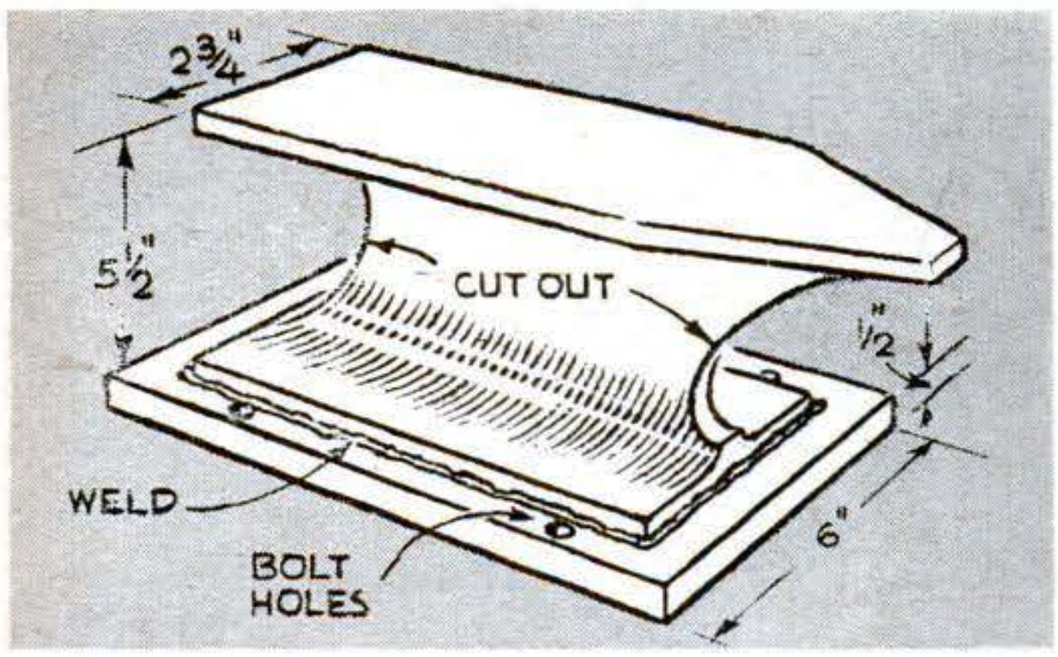
Short Cuts and Tips

FROM PS READERS



Anvil Made from I-Beam

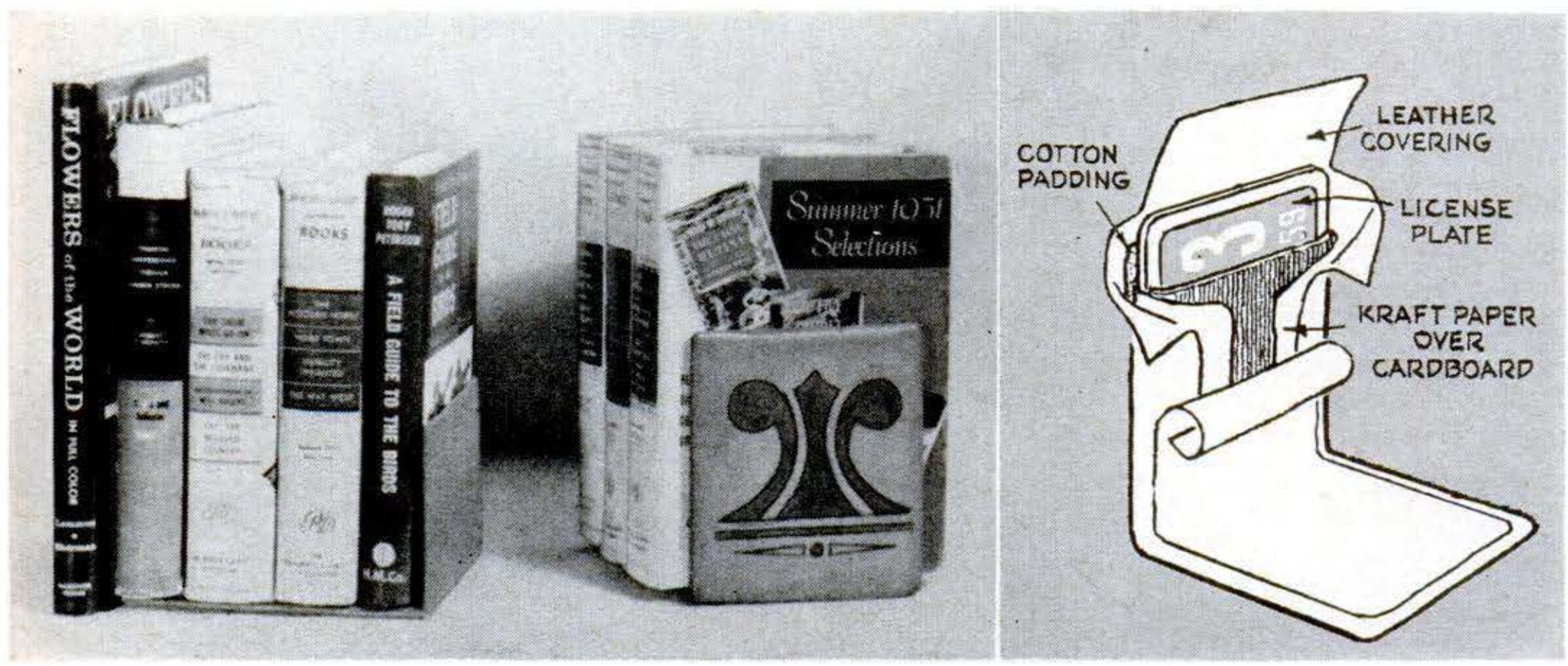
HERE is a simple anvil made from an I-beam and a piece of ½" steel plate. It could be made any length; mine is about a foot long. Bolts hold it in place.—*Harold D. Burgess, Battle Creek, Mich.*

▶▶▶WOODEN window screens can be prevented from sticking to the sill by driving brass upholsterer's tacks into the bottom edge of the frame. Use one about 2" from each side. The opening made by the tack heads is too small to admit flying insects. —*J. L. Massett, Washington, D.C.*

Preventing Faceplate Slip

WOOD turnings held by the center screw to a lathe faceplate tend to slip. As a remedy, try swabbing the plate with a light coat of sandpaper-disk adhesive. —*Walter Johnson, Chicago.*

▶▶▶IF YOU want to add a hole to a nylon watch band, heat the tip of an ice pick. With the band on a block of wood, press the hot point where the new hole is desired. The hole will be round, and lined with melted nylon to prevent fraying.—*Roger Francis, Jamesville, N.Y.*



How to Make Book Ends from Old License Plates

INSTEAD of nailing your old license plates to the garage wall, you can use them as the framework for a pair of practical book ends. First, bend each plate crosswise in the middle. Sandwich the metal between sheets of thin cardboard, and cover with moistened kraft paper. When dry, the paper will shrink to provide a smooth surface. Thin leather of various colors and finishes can then be pasted on, much as a book cover is constructed. The vertical ends of the bent plate may be padded with cotton, if desired.—*Robert P. Nute, Cincinnati.*

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How a California craftsman made—

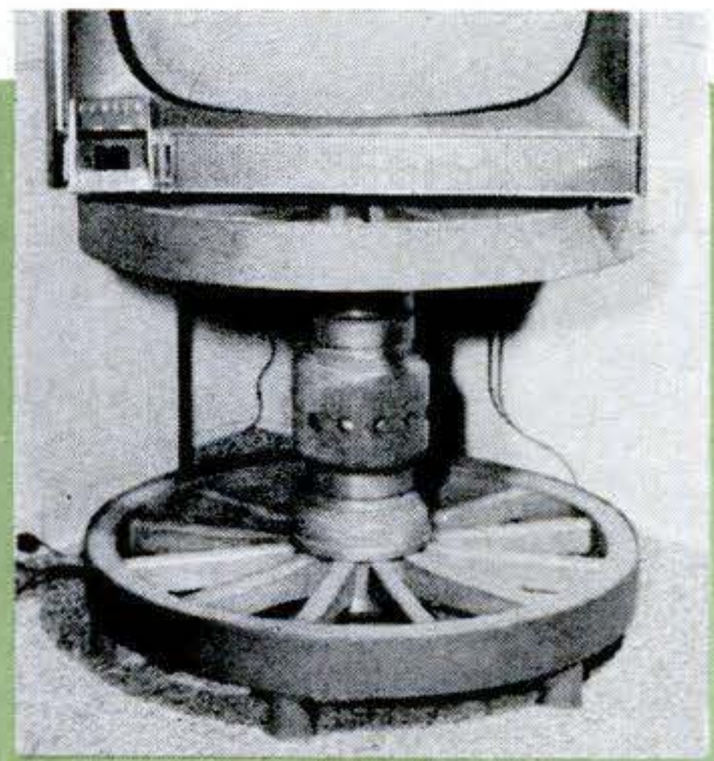
A Wagon-Wheel TV Turntable

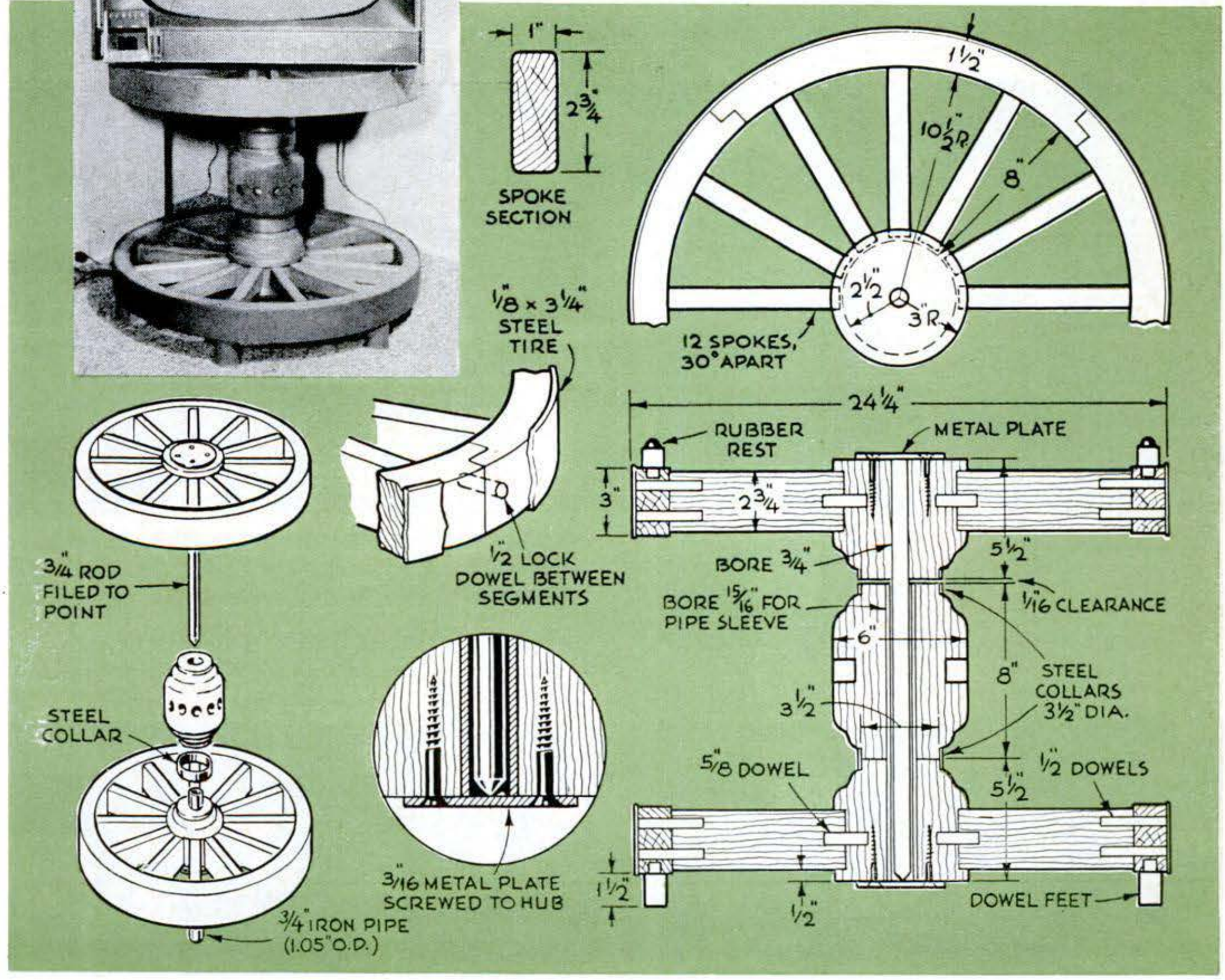
THIS wagon-wheel stand combines the rich beauty of lathe-turned natural wood with a modern swivel for a TV set. The rotating action is very smooth as the entire weight of the set is carried on a pointed steel spindle.

O. L. Rumble of Balboa Island, Cal., copied real wagon wheels for the stand, scaling them down to 24¼″ in diameter. He used birch, but oak or other hardwood could be substituted. All joints are doweled and glued.

The upper hub is bored for a length of ¾″ steel rod, which serves as the pivot. This turns in a sleeve made from ½″ pipe that runs through a spokeless middle hub and the hub of the lower wheel. All three hubs are turned to the same contours—except for the grooves for the spokes in the top and bottom ones. The grooves must be carefully shouldered to provide a good square fit for the spoke ends.

The rims are each made up of four 90-degree segments, or felloes, which can be curved on a bandsaw or jigsaw. Mr. Rumble used one-piece, 24″-diameter steel tires. These were shrunk in place over the rims by heating the metal first. For a simpler job, lengths of steel scrap could be screwed on with the joints at the rear where they won't show. Six wood feet are doweled into the bottom rim, and four rubber rests, raised so that the television set will clear the hub, are fastened to the top rim.





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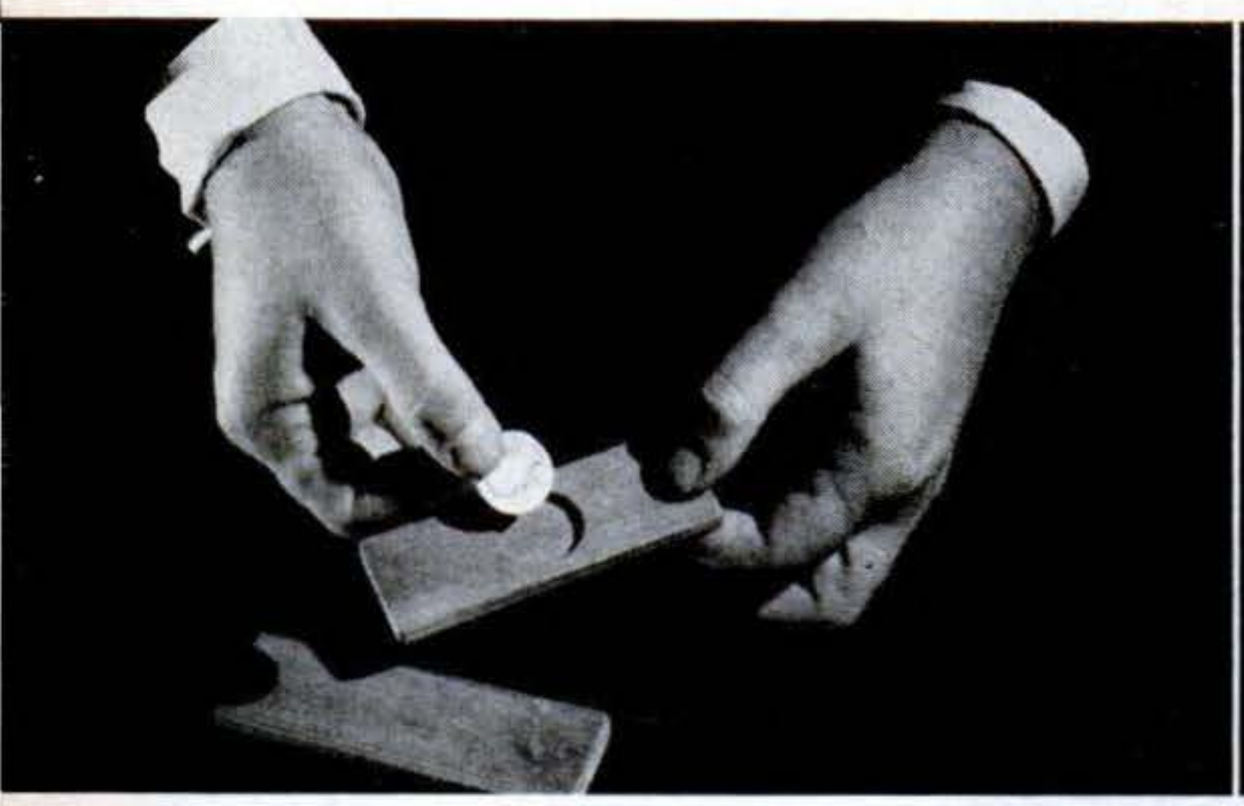
Two one-evening shop projects:

Home Magic: Make Your Own Money

BILL PRINTER

CRANK OUT THE DOUGH: Blank paper goes in, money comes out. Play money is shown, but you can use real bills to amaze your friends.

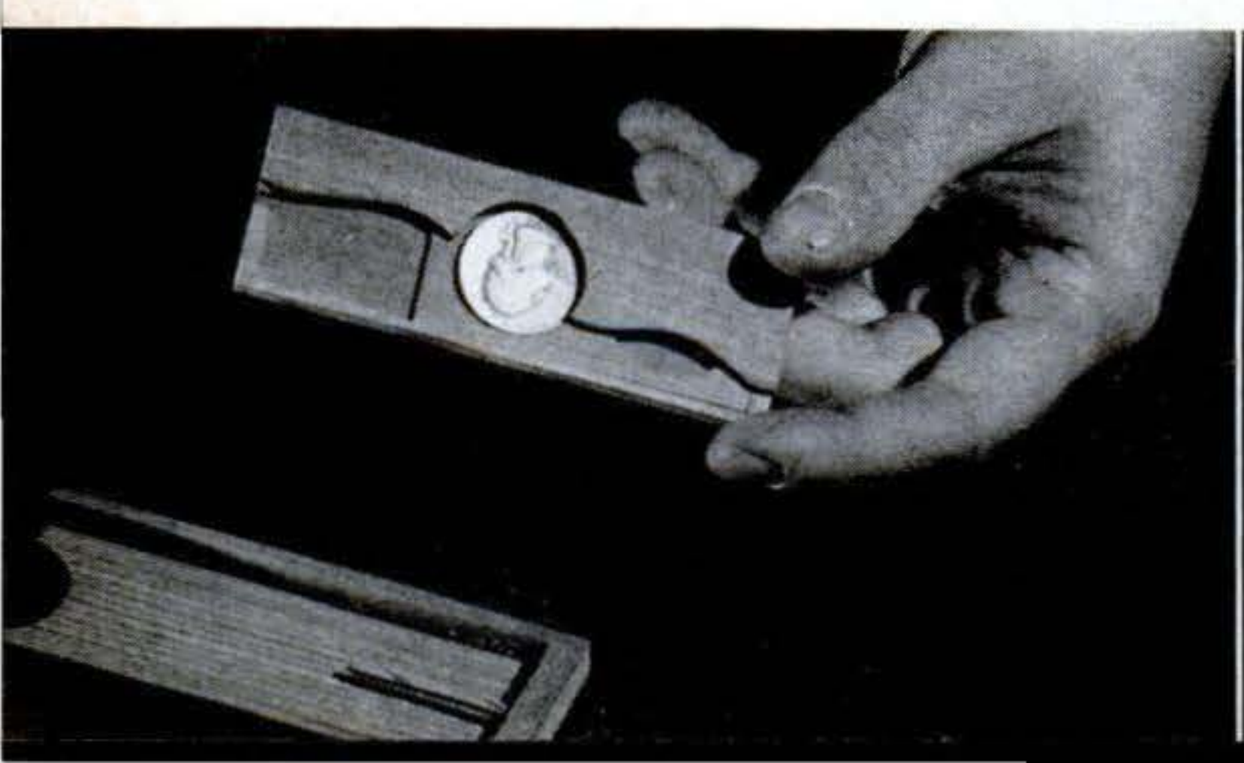


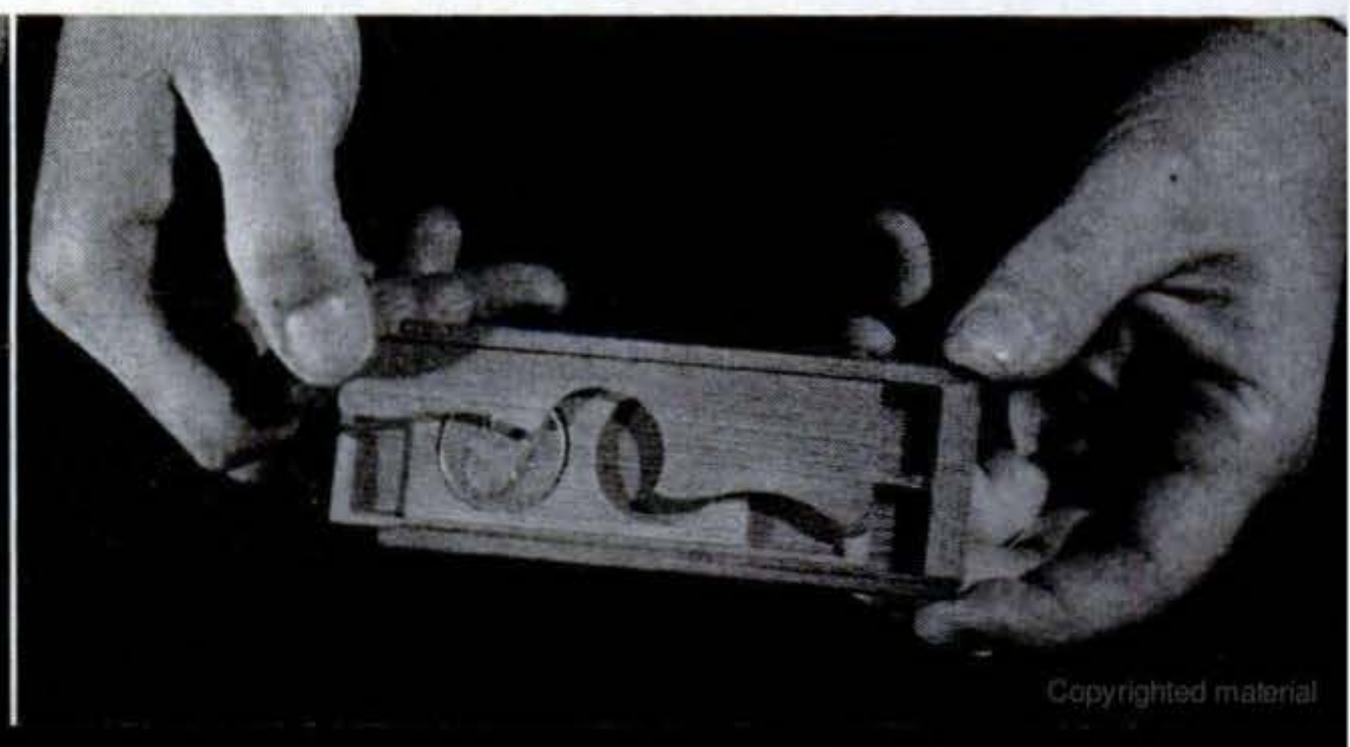
COIN CHANGER

CHANGE DIMES INTO QUARTERS: Place a quarter in position in advance and insert the inner box in the outer box to make the pin (see below)

How it works

CUTAWAY REVEALS TRICK: One or the other of two holes in tray line up with a single hole in inner box when tray is pushed to either side.





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By Burnart Wolfe and Herbert Pfister

FEED blank paper into the rollers of a "printing" machine and a dollar bill comes out the other side. Place a dime in a little box and it becomes a quarter. This sound like the answer to all your problems? Yes? Well, actually you plant your own quarter and dollar bill first in a couple of clever props. Then you astonish your audience. Fun is your only profit.

Scraps of cedar or maple can be used to make the gadgets. Either wood can take a lot of handling before becoming soiled, so you won't have to do any finishing.

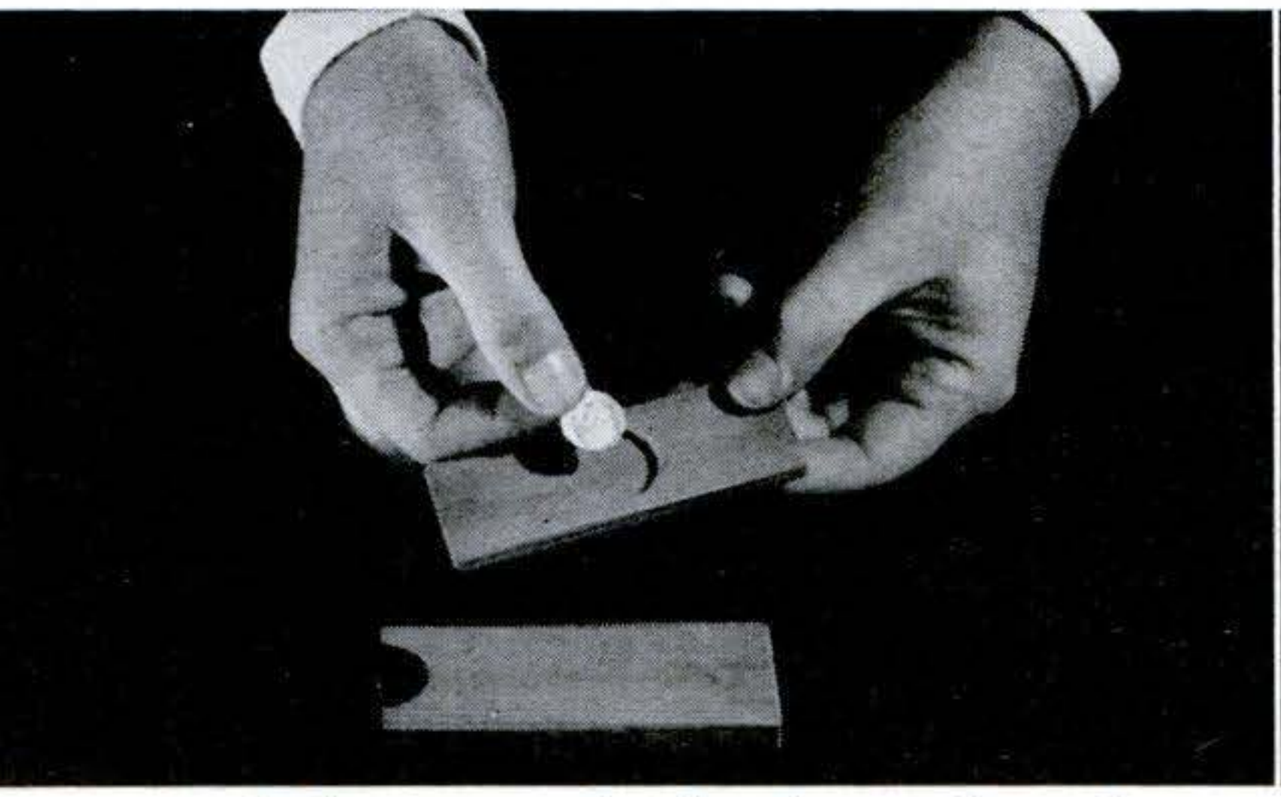
The coin changer is a sliding tray sealed inside a box-within-a-box. The outer box has a pin in its blind end. When you push the inner box into it, the pin slides the tray back and forth to push the quarter into the opening occupied by the dime.

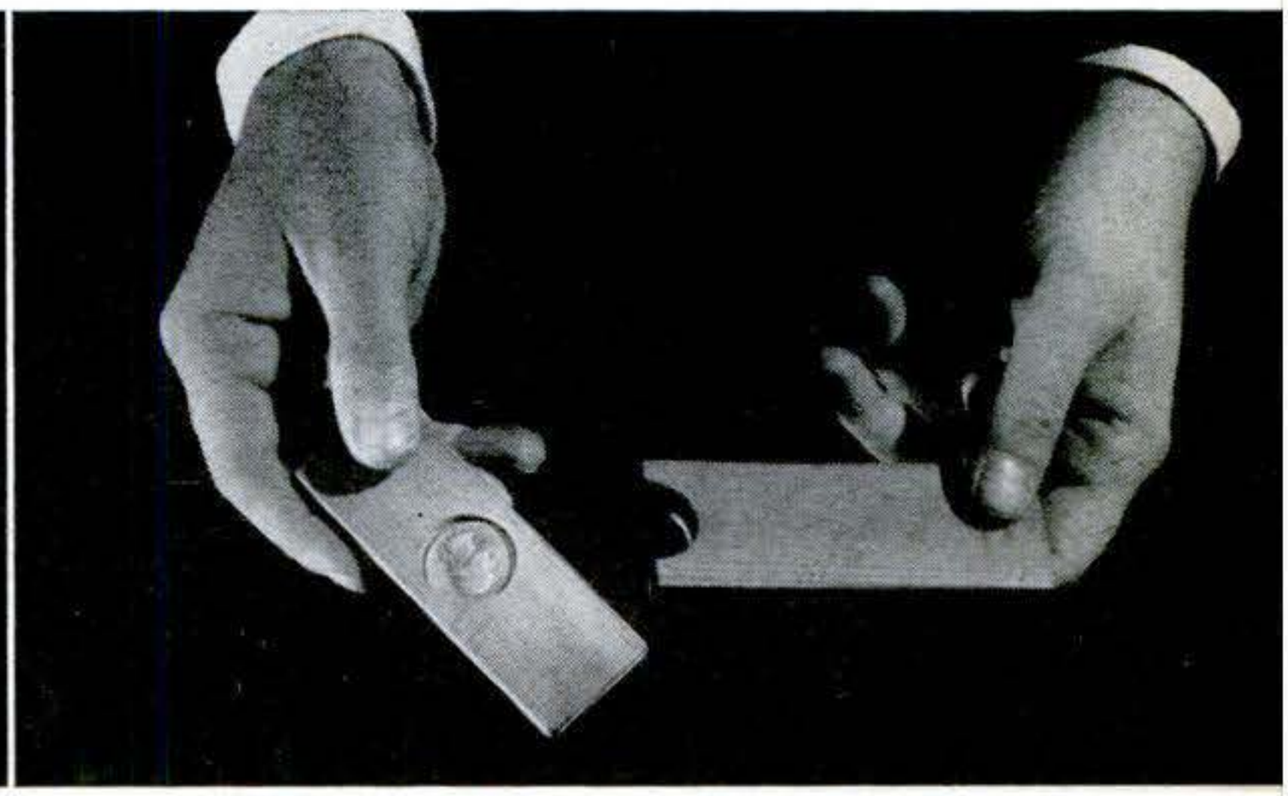
Cut the wood carefully to dimensions given in the drawings, taking particular care with the inner box and tray. Inaccurate fitting of these parts would cause the coin hole to align poorly, giving the trick away on sight. Sand the tray lightly until it slides easily inside the frame of the inner box, then glue the cover on the inner box to seal the tray permanently inside.

Make the outer box so that its frame fits snugly around the inner box. Glue the pin in place and slide the inner box onto it from both ends to check the travel of the tray. Trim the pin with a razor blade until it is the right length. When you're satisfied that the trick works smoothly, glue the cover on the outer box.

The bill printer requires two 4″ lengths of 1″ dowel and a yard of 4″-wide grosgrain or taffeta ribbon. Black ribbon is best as it conceals what's going on better than bright colors.

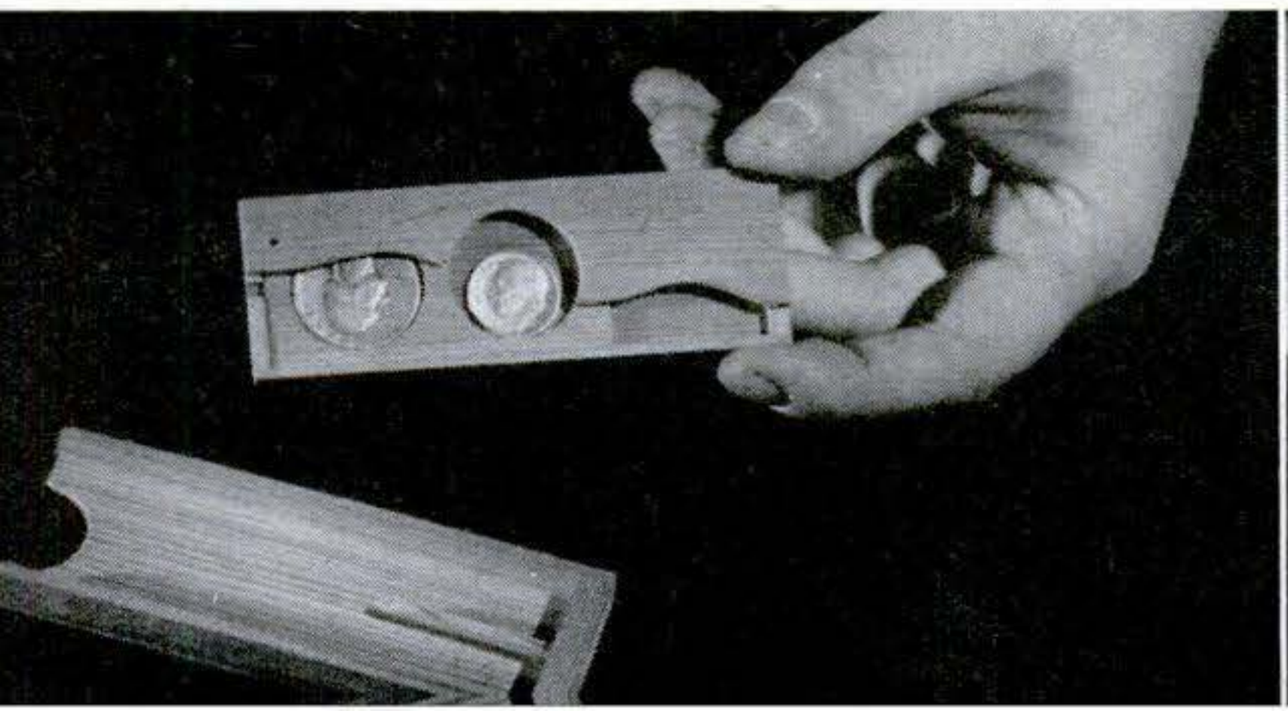
Cut the two end pieces and drill ⅜″ holes for the roller shafts, then glue the ends to the 4″-wide base. Bore ⅜″ holes about 1″ deep in both ends of the 1″ dowels. Glue ⅜″ dowels into the knob and crank. Put a dab of glue on their ends, insert them in the holes in the end pieces and press them into rollers. Support the two remaining roller ends with

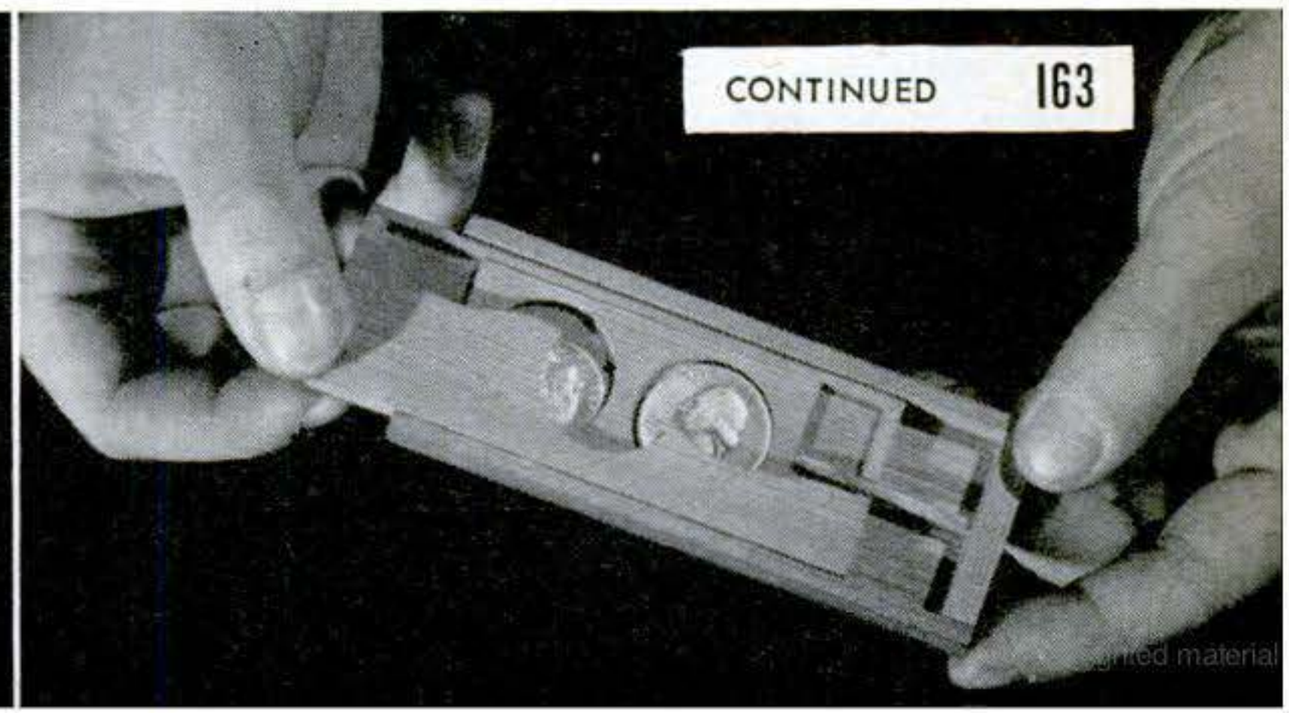




push the coin out of sight. Then, in front of your audience, place a dime in the hole in the inner box. Put the inner box in the outer box and remove it while mumbling magic words. The pin will push the quarter back into position to be revealed and shove the dime into hiding.

Quarter placed in the hole is shoved out of sight when pin pushes tray, leaving a vacant hole in view as you start your act. The dime is placed in this hole. When you put the two boxes together again, this time with the inner box reversed, the pin makes the magic switch.





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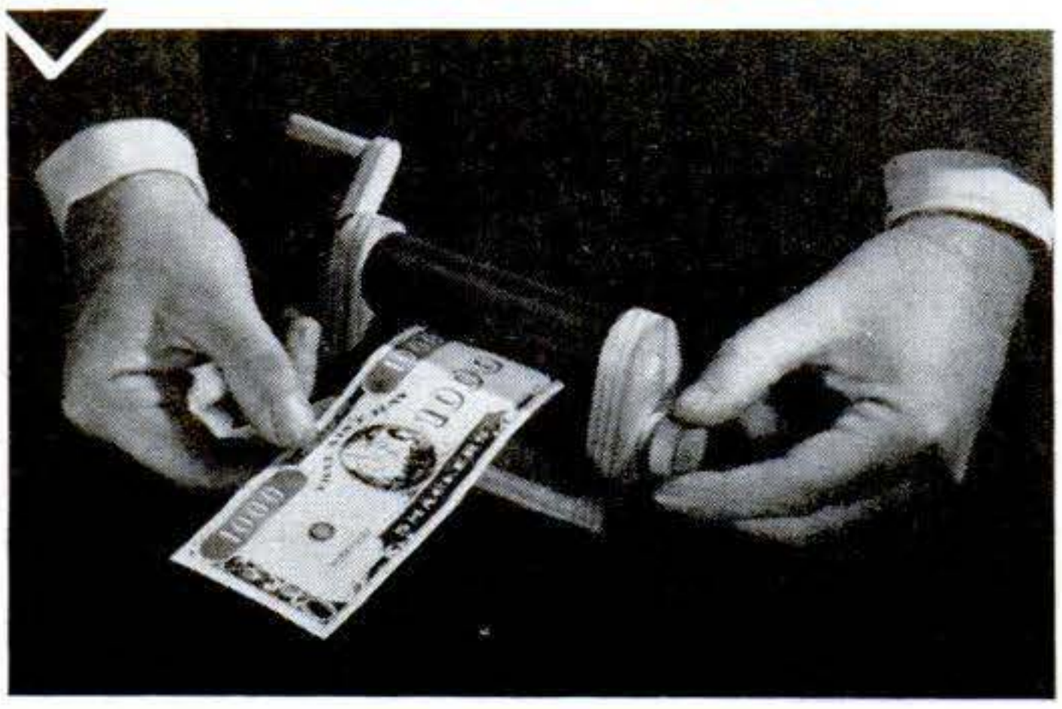
short 3/8" dowels cut flush with the end pieces.

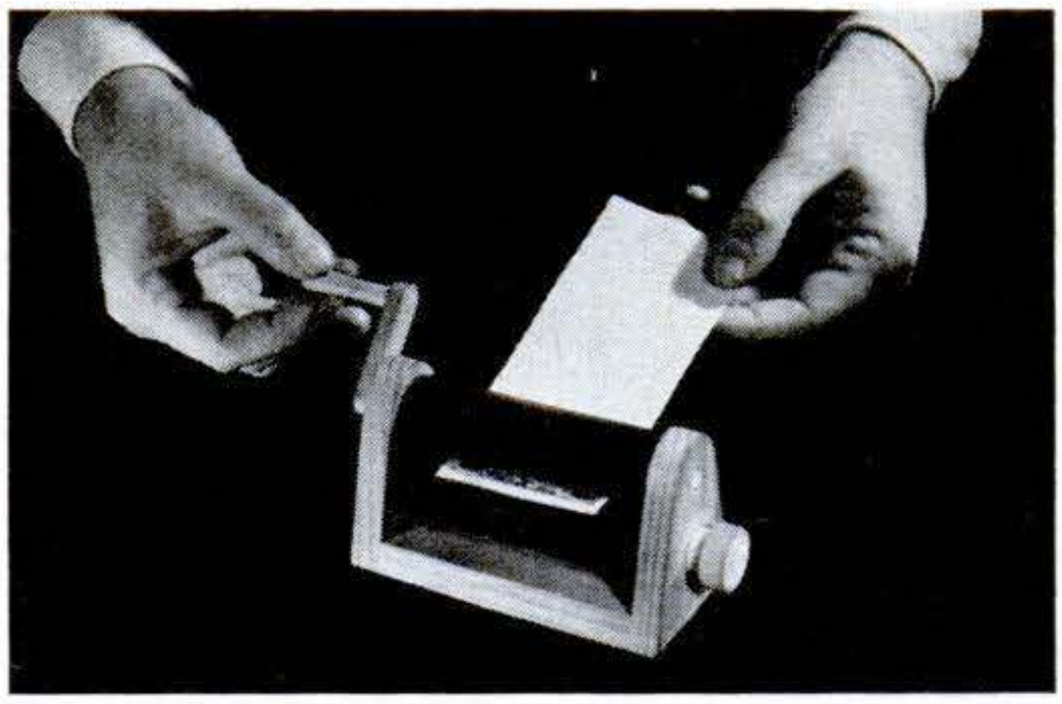
Glue the ribbon one complete turn around each roller to cover them completely. Note that the ribbon follows an S-shaped path as it moves from one roller to the other. Since both sides of the ribbon are identical, the effect produced is that of two separate cloth-covered rollers saturated with black ink.

Practice a bit before you demonstrate your tricks to an audience. Few performers can look more pathetic than a clumsy magician.

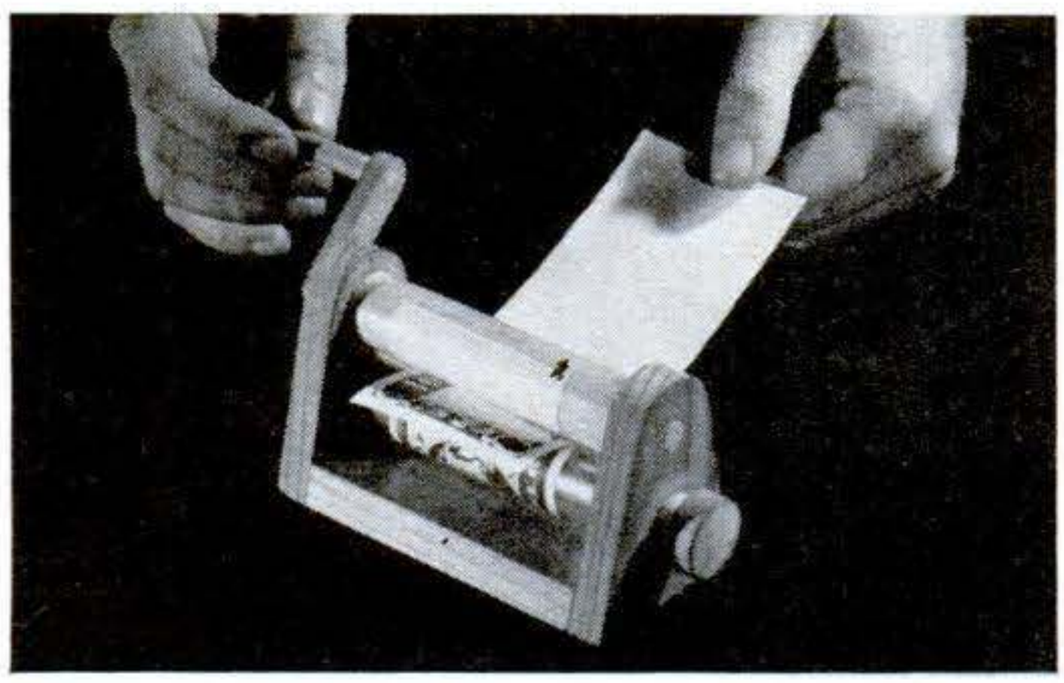
How the Bill Printer works



BEFORE "PRINTING" MONEY, you rig the machine for the trick. Insert a bill, as shown above, and turn the roller knob toward you until the bill just disappears between the rollers.

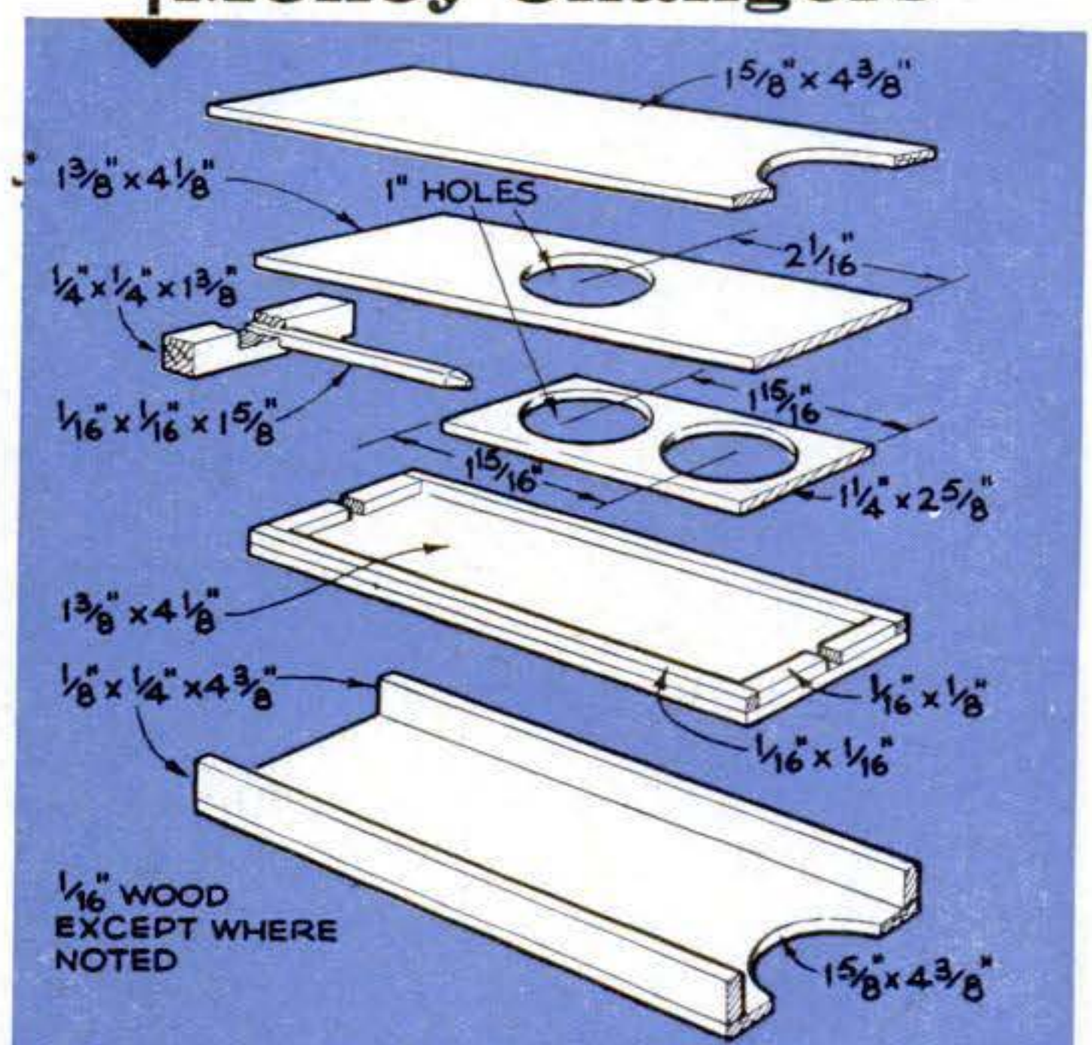


READY FOR YOUR AUDIENCE, you slip a paper blank into the rollers and turn the crank toward you, counterclockwise. As the blank enters, the real McCoy comes out the other side.

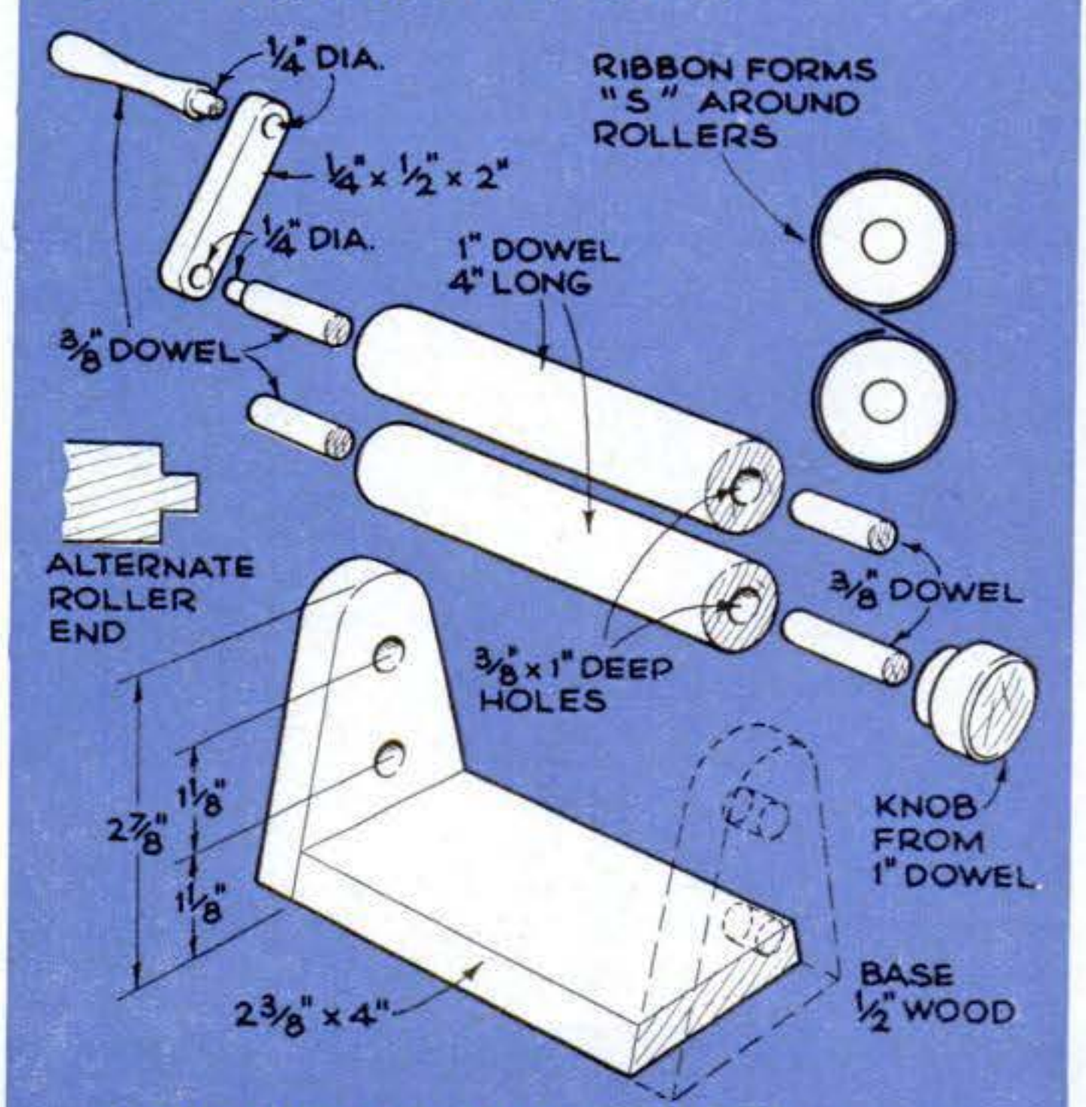


CLEAR PLASTIC RIBBON shows secret. Planted bill, wrapped in ribbon around the lower roller, is ready to come out as blank paper is fed into the ribbon around the upper roller.

How to make the Money Changers



CUT ALL PARTS 1/16" thick except sides of outer box. Sand surfaces of parts that slide until you get easy movement with slight drag. Tray should move only when pushed by pin, not by gravity.



RESEMBLING A CLOTHES WRINGER, toy-size bill printer is a simple frame of 1/2" wood supporting two rollers of 1" dowel. Buy 4"-wide ribbon first, and build machine exactly to its width so edges are not exposed to give away the trick.

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Short Cuts and Tips

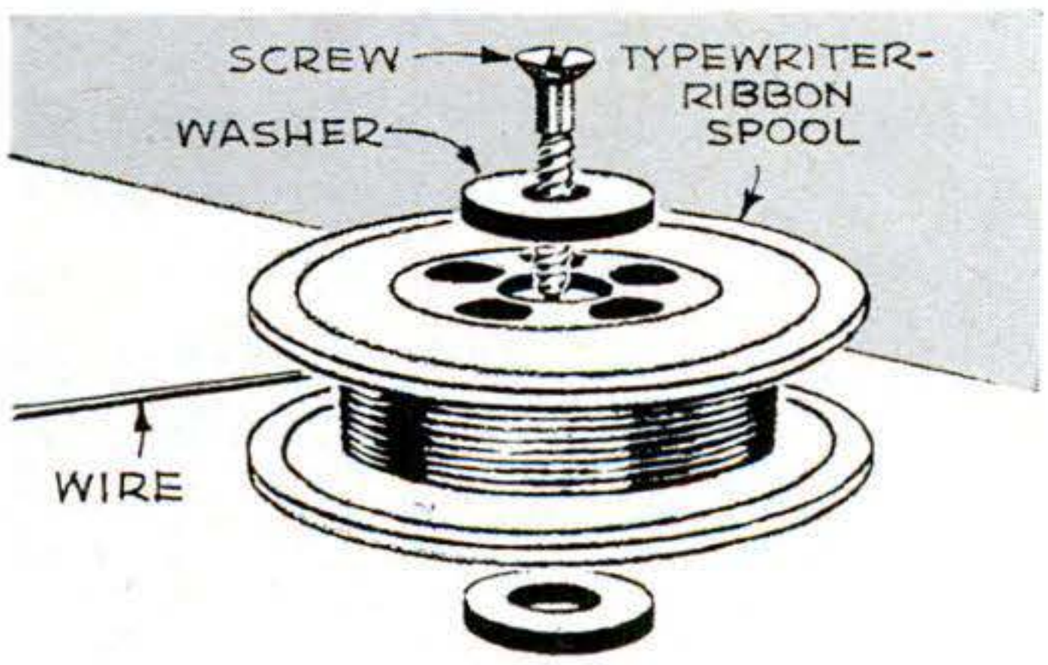
FROM PS READERS

Drink Mixer Can Drive Models

BATTERY-OPERATED "swizzle" drink mixers make self-contained power units for small ship models. One weighs only four ounces, holds a standard battery, and has a long, removable drive shaft easily adapted to a prop. I buy them for about $3 each from John Surrey Ltd., 11 W. 32nd St., NYC., or a Hoffritz cutlery store.—*Capt. L. S. McCready, Kings Point, N. Y.*

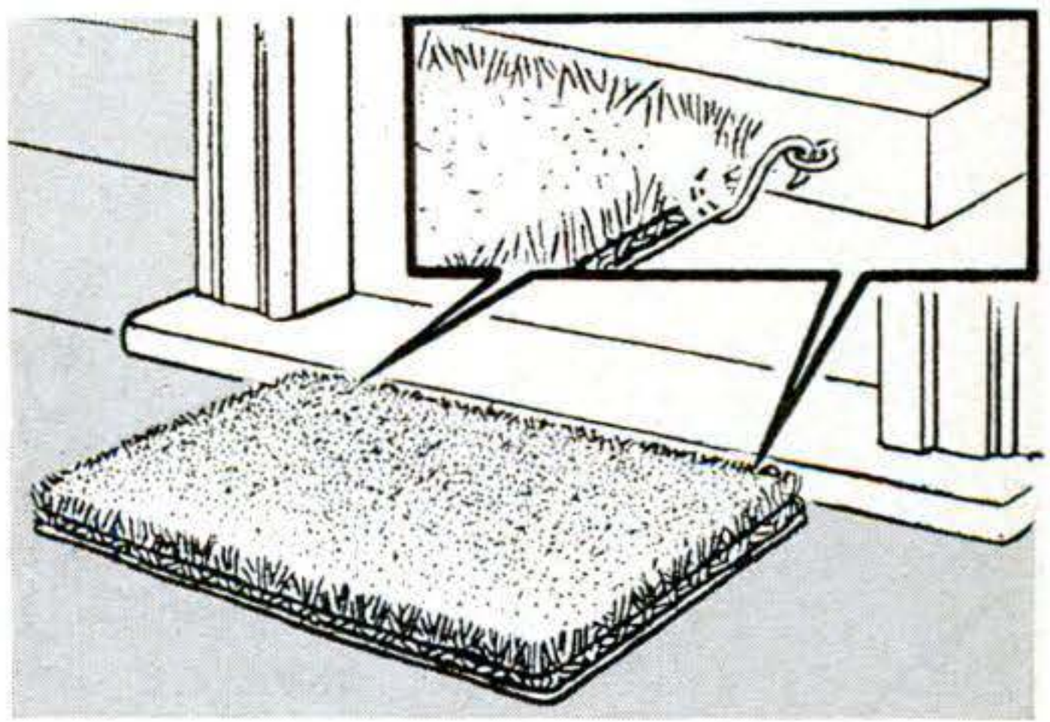
Dime-in-Hand Is Handy Screwdriver

I ALWAYS keep a dime in the adjustment cover of my telescopic rifle sight. The coin is just the right size and thickness to fit in the cover and for making small adjustments that call for a screwdriver.—*John Krill, North Lima, Ohio.*



Wire Coiled on Empty Spool

A TYPEWRITER-RIBBON spool, with the old ribbon removed, makes an excellent reel on which to wind light copper, brass, or steel wire. With a washer on each side, screw the spool into a board or studding just firmly enough so it can be turned.—*R. S. Brown, Hyde Park, N. Y.*



Anchors for a Door Mat

HERE'S an easy way to make a door mat stay put. Work the ends of a pair of large S-hooks into the mat backing. Then attach the other ends into screw eyes driven into the sill edge. Removing the mat for cleaning requires only unhooking. —*Leonard H. Victor, Corning, N. Y.*

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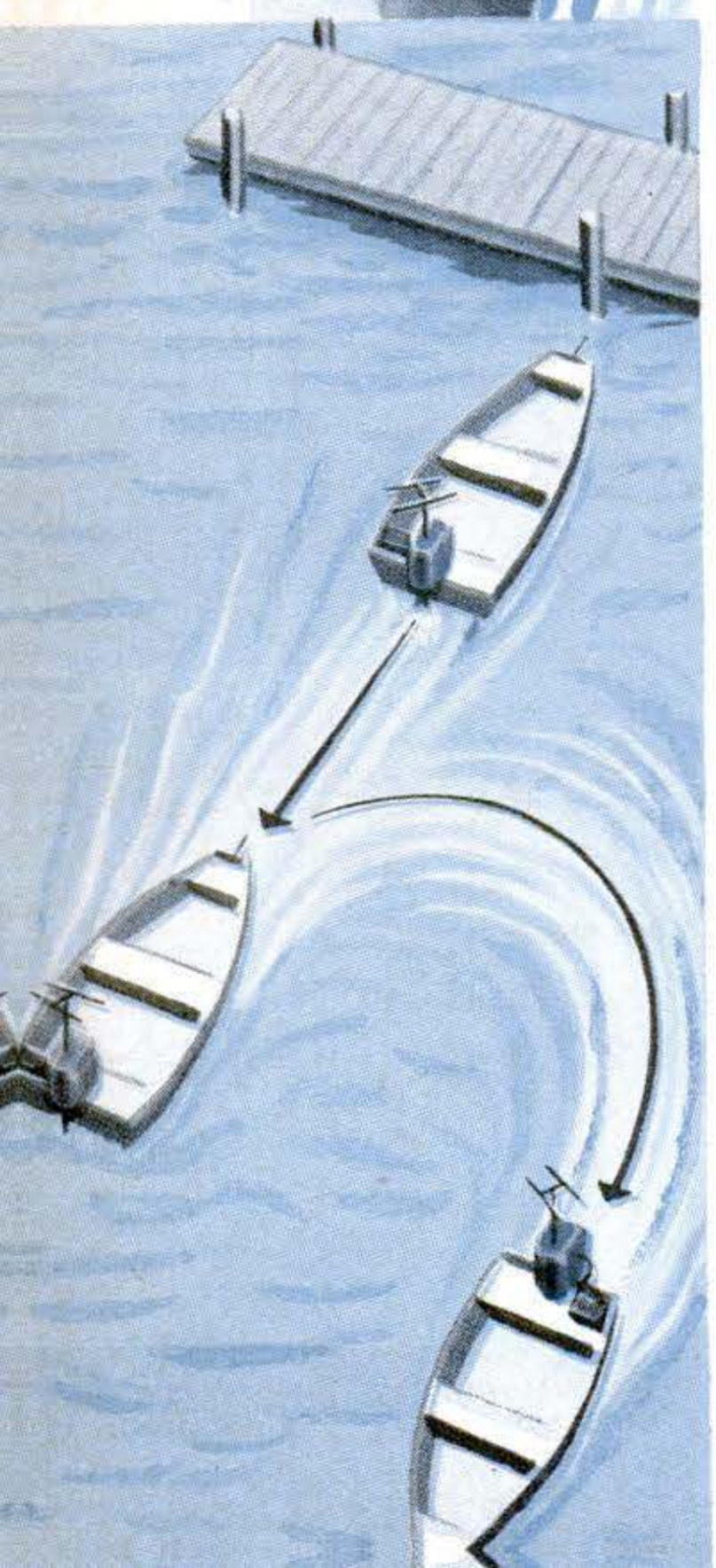
AN ENGINEER'S REFLECTIONS
on how you might go about

Building a Radio-Controlled Dinghy



A RADIO-CONTROLLED dinghy? Could *you* build one? Would it be possible? A boat that would go where it was told to, with nobody aboard to guide it? When that question was raised at PS some time ago, everyone thought it an intriguing idea. So we asked Joseph Whitehill of Easton, Md., a practical engineer, for his thoughts. Here's his answer:

Sure. I figure that it would be fun, and useful, to modify a dinghy so that it would act like an unmanned yacht-club launch. Consider what usually happens: Mr. and Mrs. Cruiser drop anchor and Mr. Cruiser goes ashore. An hour or more passes and the marooned Mrs. Cruiser's temperature begins to rise dangerously.

Now see another scene. Mr. and Mrs. Gadget drop anchor, and Mr. G immediately goes ashore. When Mrs. Gadget gets her hair all fixed for a public appearance, does she fret and boil? Not a bit. She stands on deck in her pretty crinoline and pushes a button on a little black

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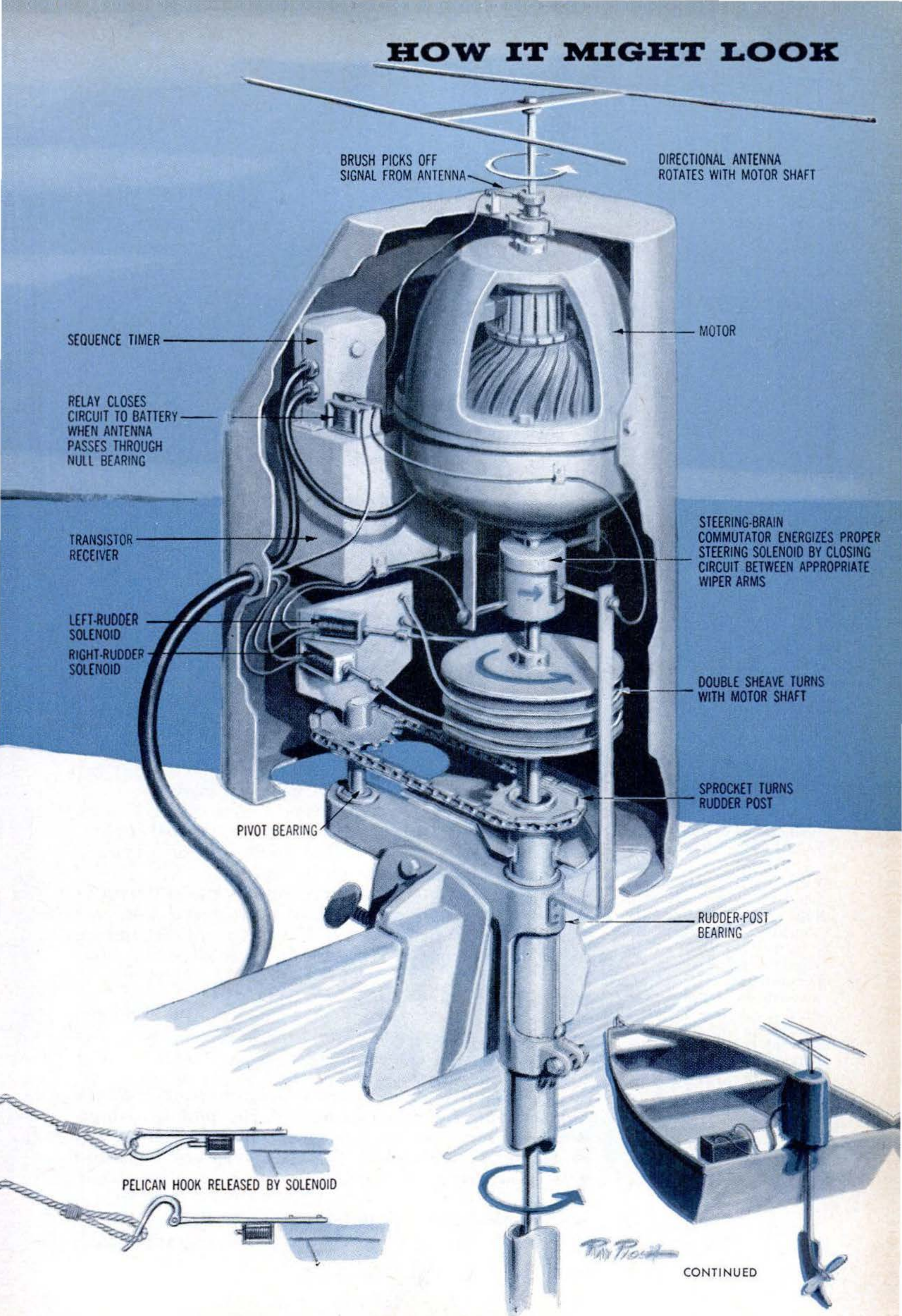
HOW IT MIGHT LOOK



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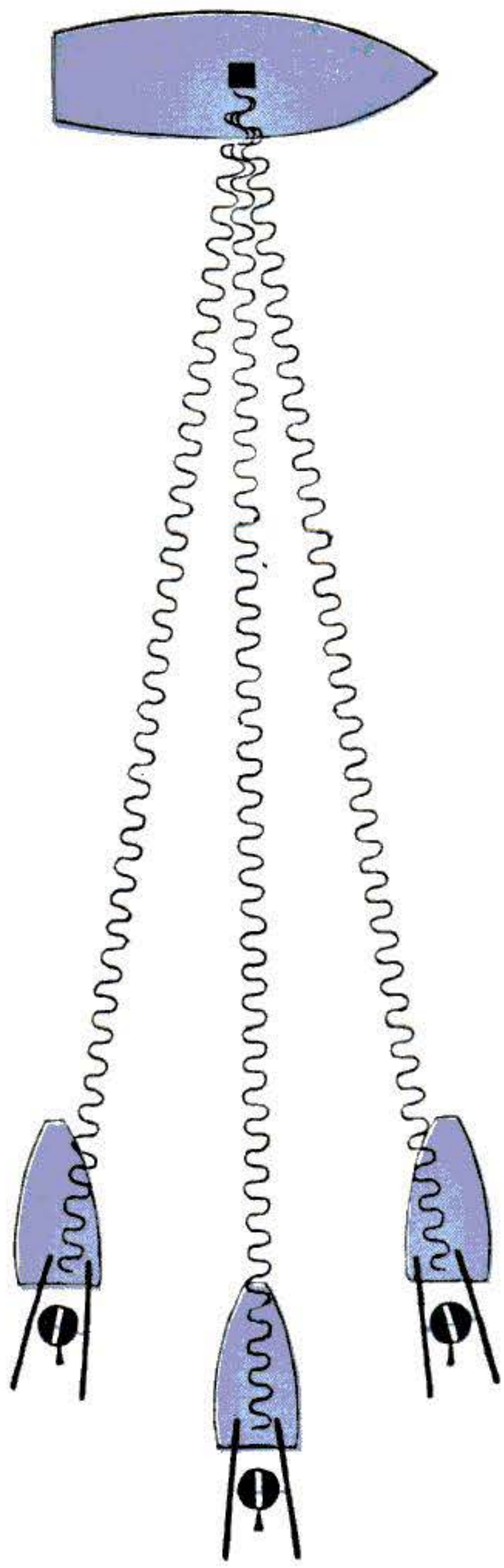

INPUT WIPER ARM is shorted to contact that feeds appropriate left- or right-rudder solenoid, depending on relation of null bearing to boat's heading. When null bearing and boat heading coincide, input wiper arm is touching insulation separating halves of the commutator. Time-delay mechanism holds solenoid until time for the next power pulse. If dinghy heading is 180 degrees off, full right rudder is applied until the boat comes around far enough for the steering brain to take over.

box. Across the water at the landing, the dinghy perks up its ears, backs away from the float, and then churns across the anchorage to the Gadgets' boat.

Method to the magic. Technically, this is the simplest kind of homing missile. Clamped to the transom of the dinghy is a little electric outboard, the kind some fishermen use for trolling. Built into the powerhead of this outboard is a transistor receiver, tuned to a Citizen's Band frequency. Mounted on the upper end of the power shaft is a ferrite loop antenna that whirls around whenever the motor is running. Also on this same shaft is a segmented commutator brushed by a wiper arm. This is the steering brain.

Sequence of events. When the receiver in the dinghy hears an incoming signal (which is steady and unmodulated in any way), the following things happen:

1. A sequence timer starts.
2. The solenoid-operated pelican hook that is holding the dinghy to the float lets go.
3. The outboard goes into reverse for five seconds to clear the dock, stops a moment, starts up forward.
4. Then scanning by the rotating antenna begins. The dinghy settles down on a course straight for the transmitter. It continues to head for it until Mrs. Gadget takes her finger off the button—whereupon everything shuts off and the boat coasts to its destination.

How it homes. The principle is simple enough. As the rotating antenna passes through the null bearing, the signal in the receiver diminishes to nothing. AVC voltage falls, tripping a transistor multi-vibrator that sends a power signal into the wiper arm, contacting a commutator attached to the motor shaft. Depending on the bearing of the transmitter with respect to the commutator (and hence the boat), a left or right impulse is fed to the steering mechanism. This turns the outboard until the dinghy is pointed right at the incoming signal.

To keep the craft from sailing off on a course 180 degrees from the signal, twin ferrite loops mounted slightly off parallel would be used. This would provide a marked front-to-back ratio for the proper course.

Time and money. If you're wondering at POPULAR SCIENCE how much it would cost to invent, test, and build the first unit for you, I'd estimate: Miscellaneous, parts, $250; dinghy, $150; 80 hours engineering time, $480; 40 hours machine-shop time, $120; allowance for bugs, $500. Total, $1,500.

This sum doesn't include what you would pay for the article and pictures, of course. But I see no reason why you couldn't have the complete story for $2,500.

So there we had the answer. A radio-controlled dinghy was feasible. And it would be fun. But plainly a single article was not worth that much, and we reluctantly called off Mr. Whitehill. His reflections are published here, however, in the hope that some readers might, just for the heck of it, build such homing dinghies. If you do, please be sure to let us see a few photos.

THE EDITORS

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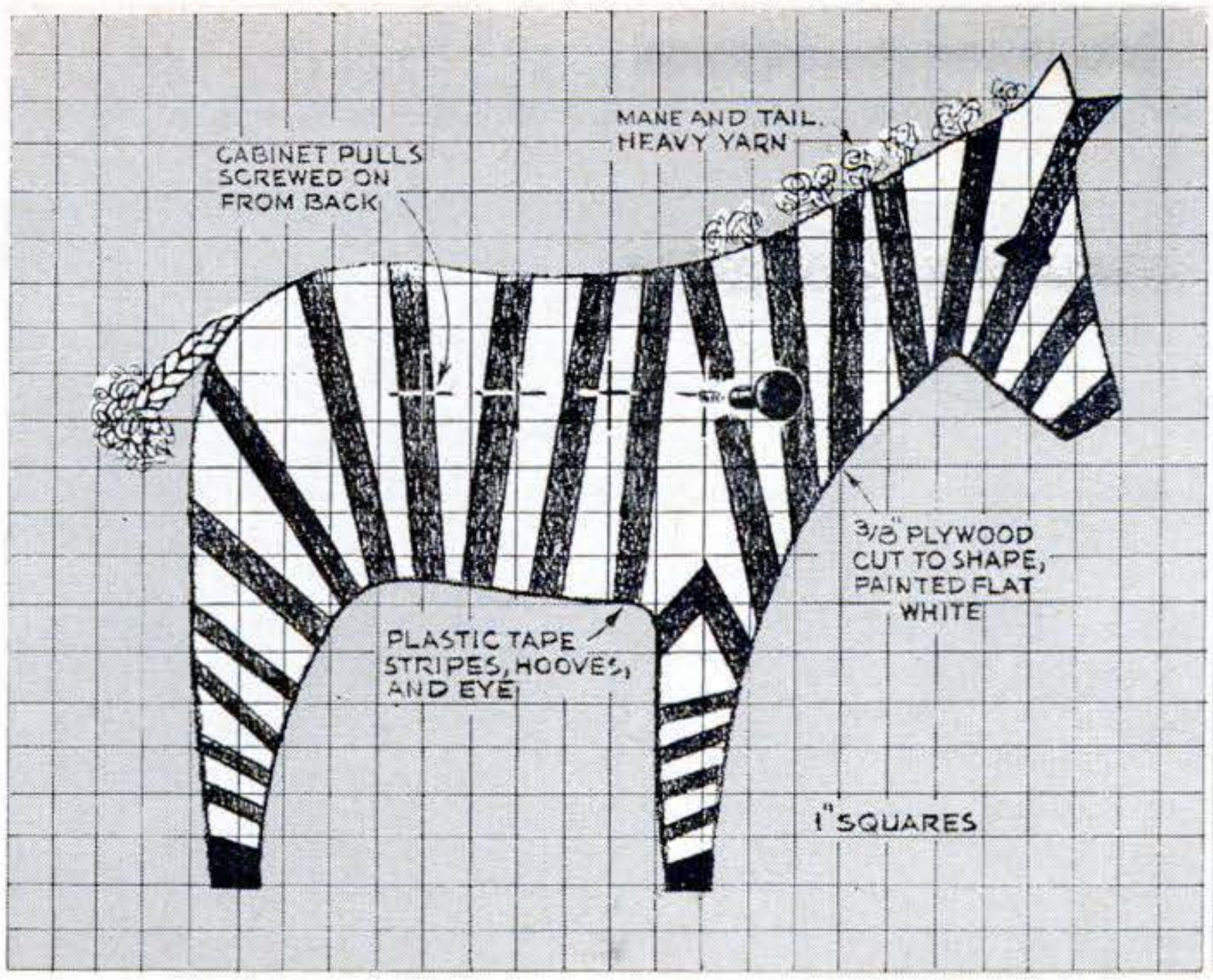
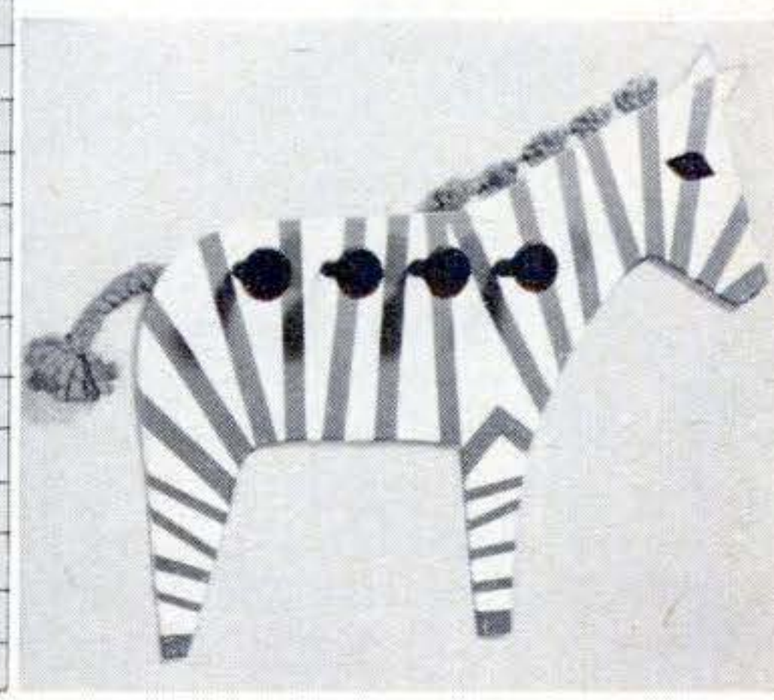
Short Cuts and Tips

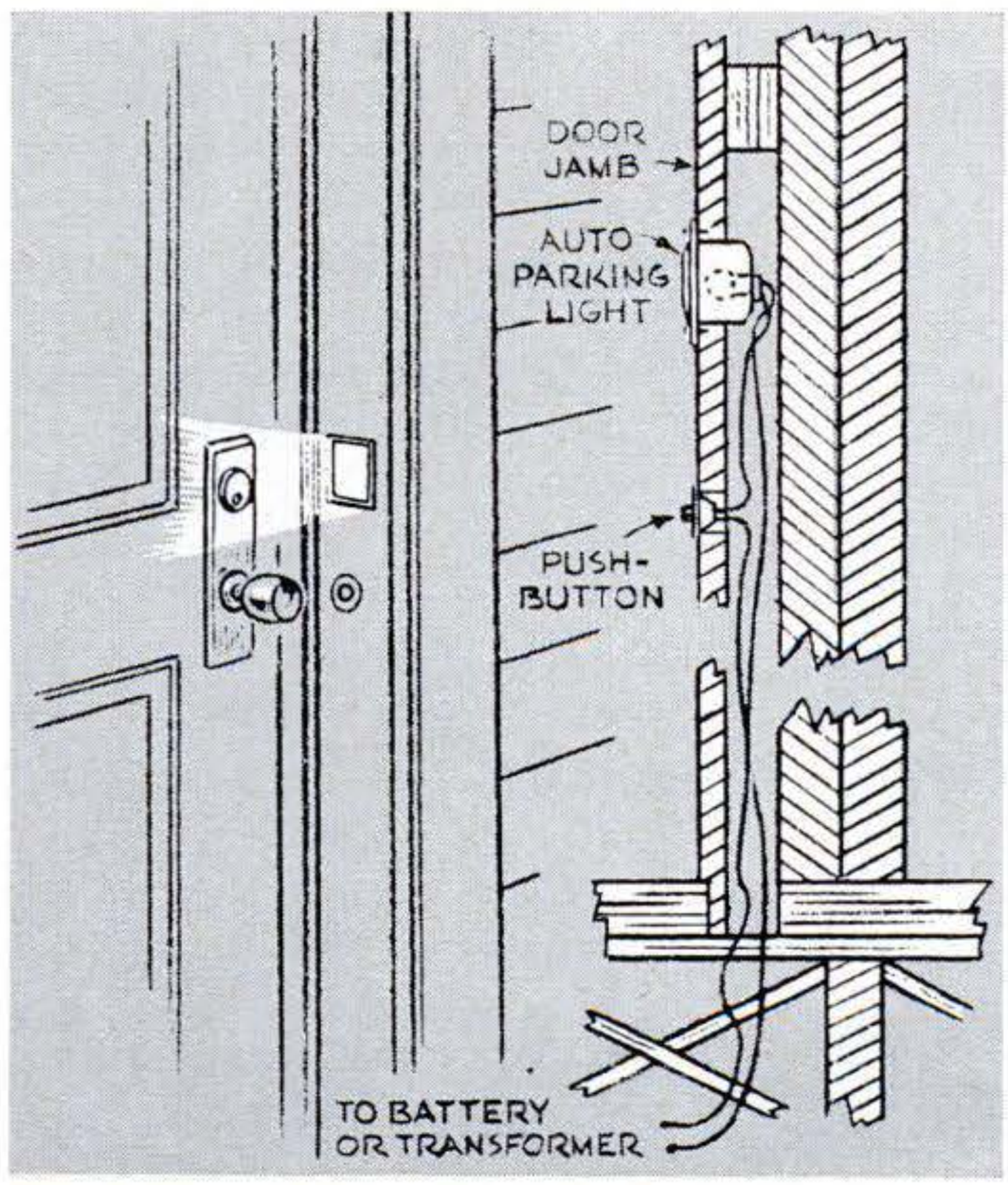
FROM PS READERS





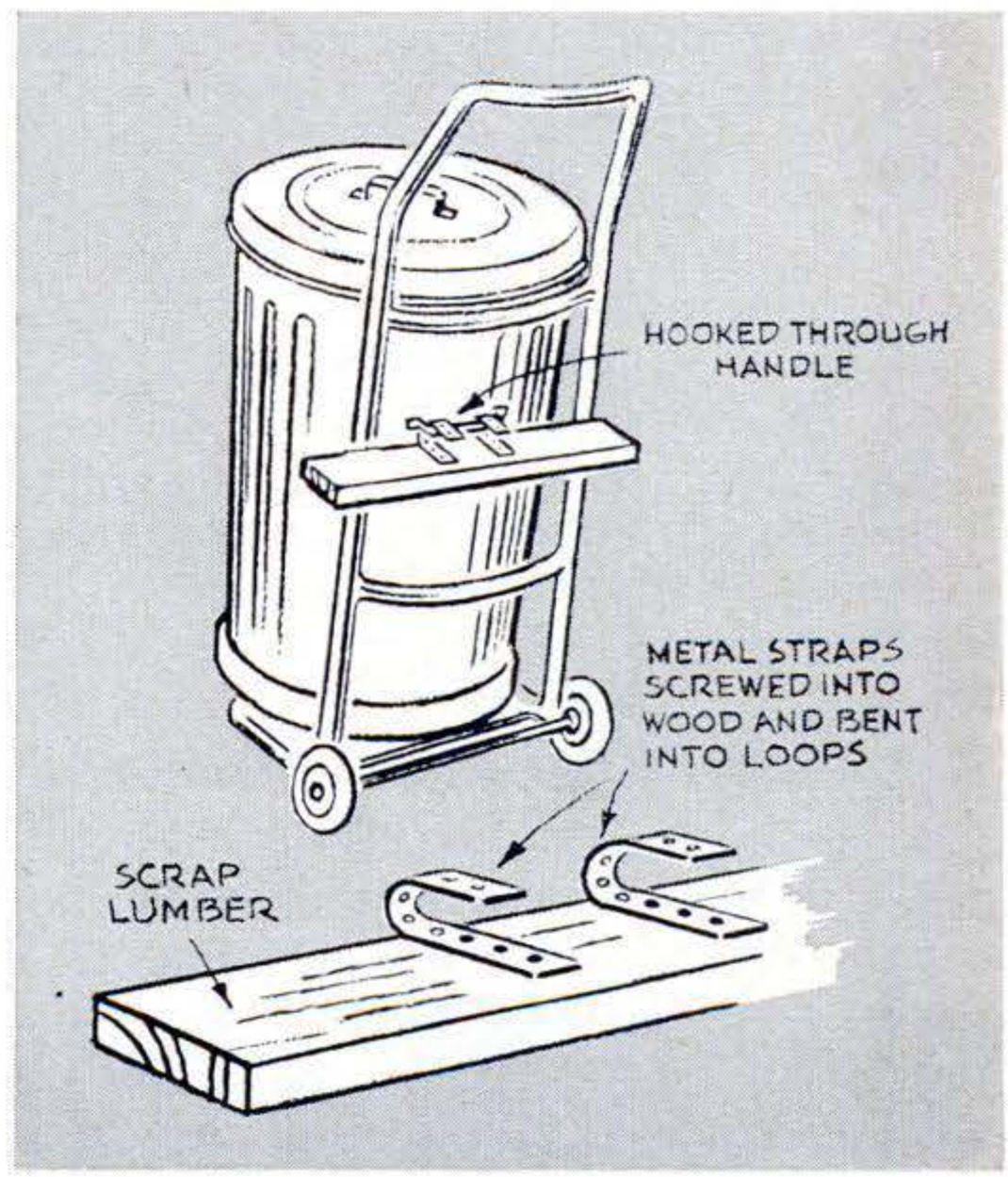
Plywood Zebra Striped with Colored Plastic Tape

STRIPED to match room colors, this zebra clothes catcher will help remind youngsters to hang up their clothes. It can be hung on the back of a door, or inside a closet, but the youngster probably will want it out in plain sight. Jigsaw it from plywood, use drawer knobs for hangers, plastic tape for striping.



Lighting Up a Keyhole

LOCATING a keyhole at night should be easy after this light is installed. A parking light from a junked automobile is recessed into the door jamb. Below the light a doorbell pushbutton is mounted and connected in series with the light. Use a bulb to match the voltage of the battery or transformer in the basement. —*Victor H. Lamoy, Upper Jay, N. Y.*



Grip for Hand-Truck Load

IF YOU have to haul heavy cans on a hand truck, try this simple locking device. Screw two strips of metal strap into a length of scrap lumber and bend them into loops as shown. Hook these through the can handle from the rear of the truck and you have a snug grip that makes handling easier and safer.—*T. D. Helmkamp, Cuyahoga Falls, Ohio.*

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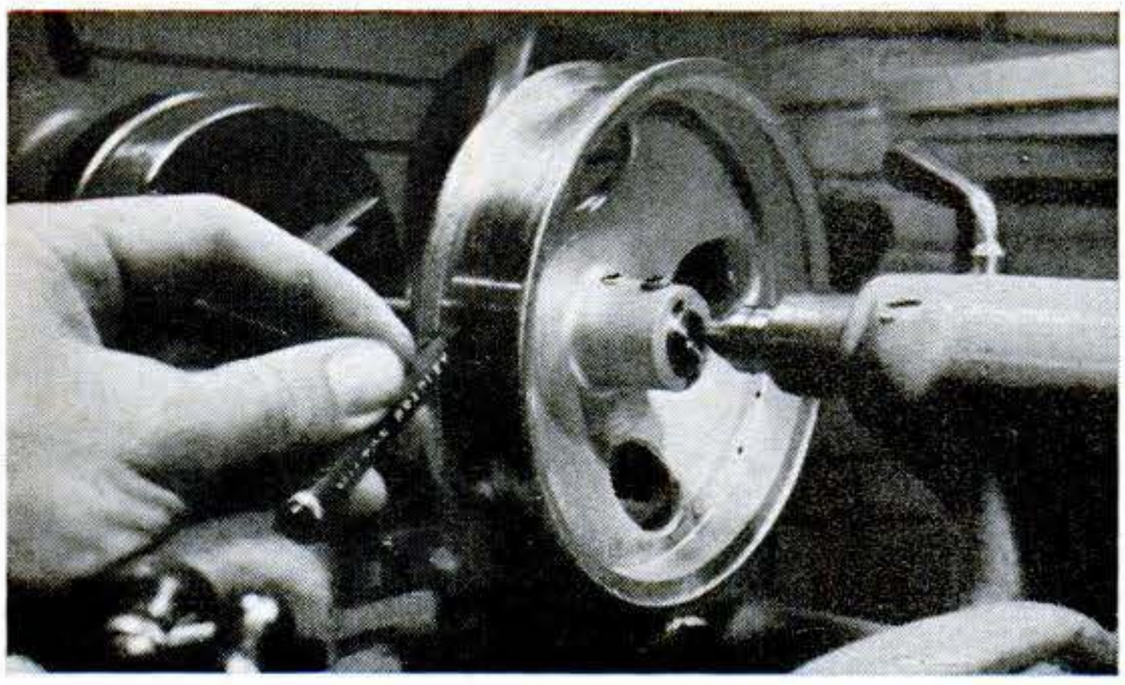
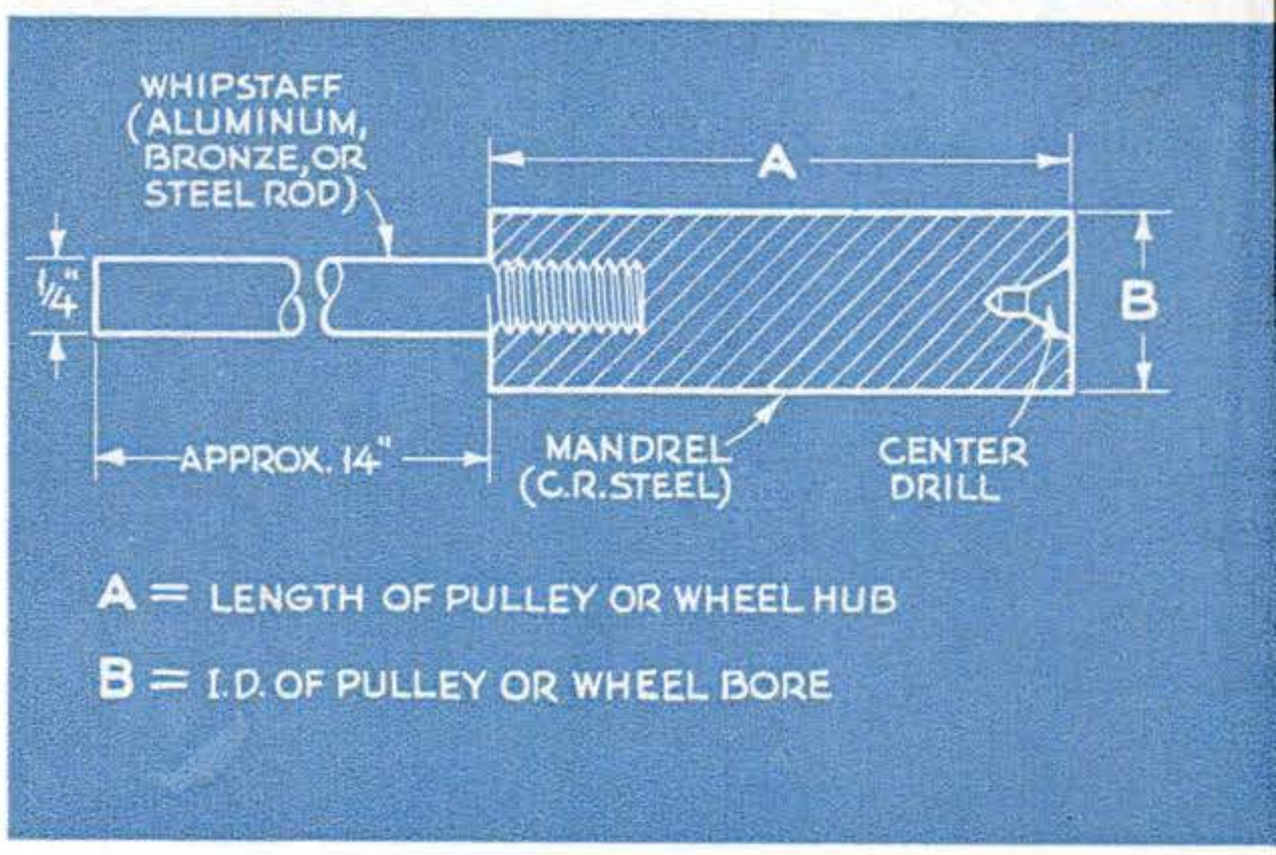
One MACHINIST tells another...



HEAVY SIDE OF PULLEY is marked automatically by crayon while pulley spins. Hold crayon firmly —not quite touching the circumference.



Whipstaff Method Does

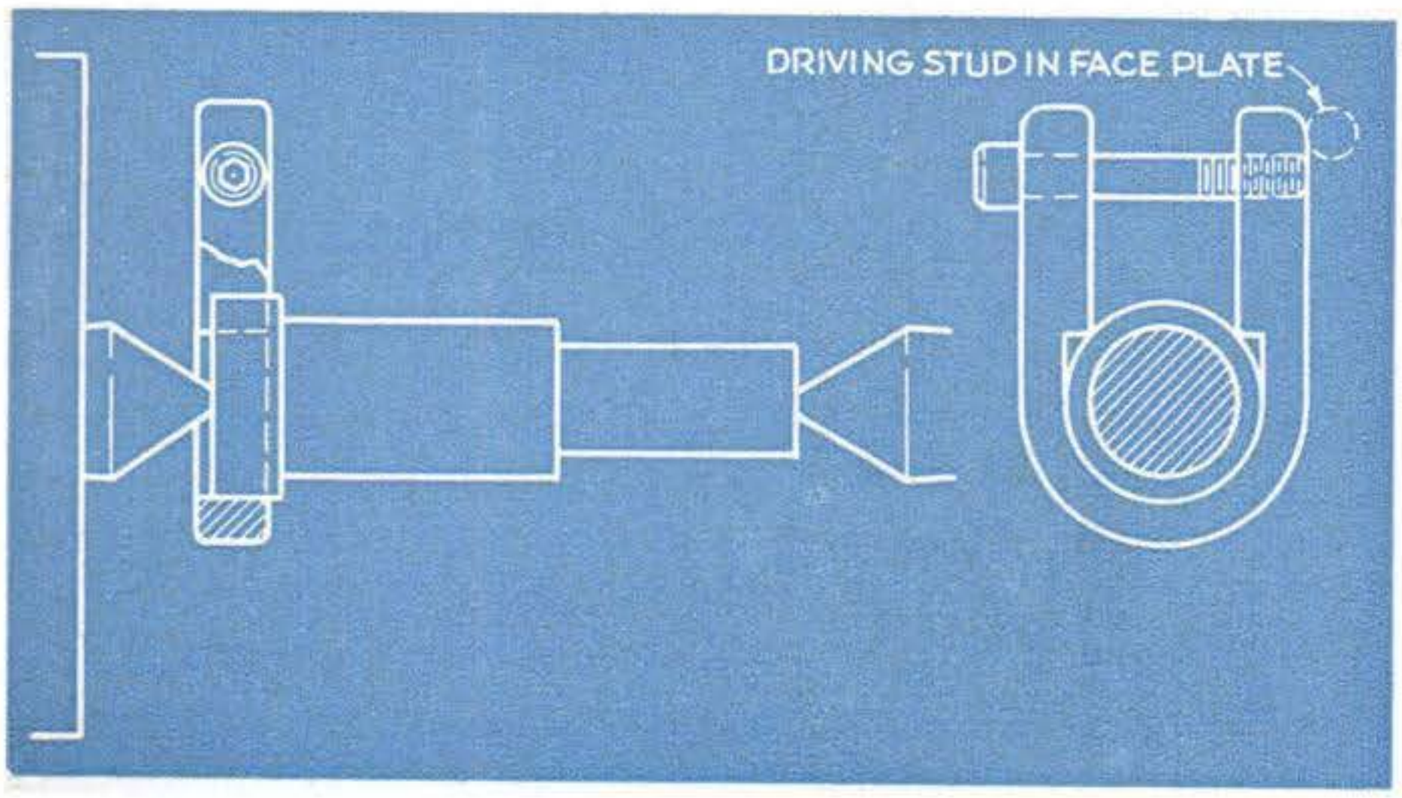
A VERY precise way to check the running balance of a high-speed pulley is to use a whipstaff. Mount the pulley on the mandrel and chuck the springy wand four or five inches away from the pulley for your first trial. Using the dial indicator on the pulley, roll the chuck slowly by hand. Bend the wand slightly, as necessary, until the pulley runs true on both its diameter and face. The wand may sag somewhat if the pulley is relatively heavy, yet with a little patience and care in bending the wand you can make the pulley run true—sag and all.

Next, run the tailstock center lightly into the center hole in the mandrel and start the lathe at a fairly slow speed—say 300 r.p.m. Hold a crayon not quite touching the pulley, then ease the tailstock center out of the center hole in the mandrel. Immediately, the heavy side of the pulley will whip out and strike the crayon. The mark will show where to remove excess weight.

Before taking the pulley off the mandrel, scribe matching lines on the hub and mandrel so they can be replaced exactly as they were. Now remove the pulley and judiciously lighten the heavy side by drilling holes in the web near the rim. Return the pulley to mandrel (remember to line up the scribed marks)

Driving Dog for Lathe Work with Narrow Shoulders

A DRIVER I made for the job makes it easier to turn work having shoulders too narrow for a standard lathe dog. It is simply a suitable length of $\frac{5}{16}$"-square stock with a centrally located notch cut about halfway through. Length of the notch should be such that when the piece is formed in a U shape, the ends of the notch will grip the work as shown. The tails are drilled and one is tapped for a #10-32 socket-head screw. Tightening the screw causes the corners of the notch to bite into the work for a positive drive. Time is saved because you can turn all diameters from one end. —*F. Murray, Chicago.*



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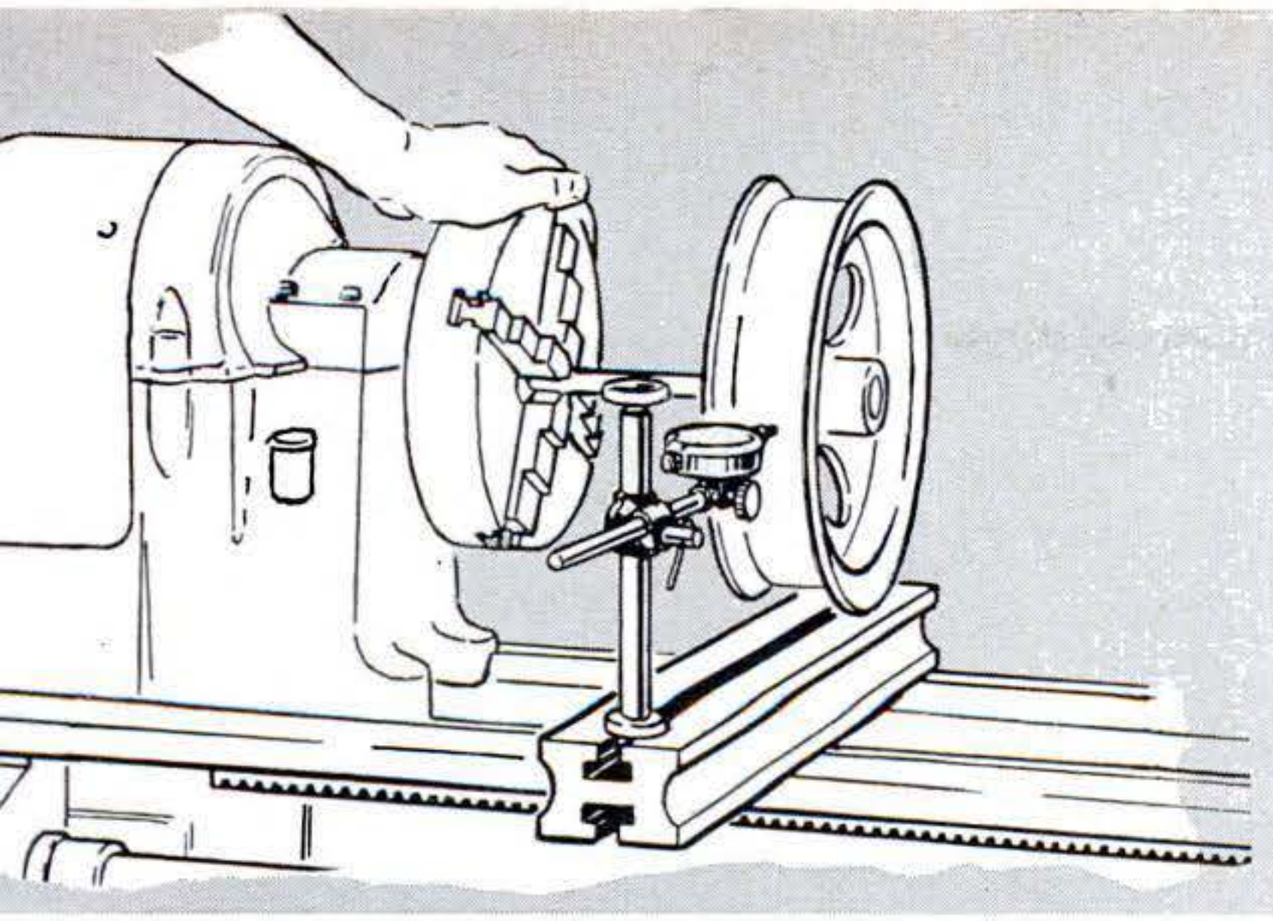
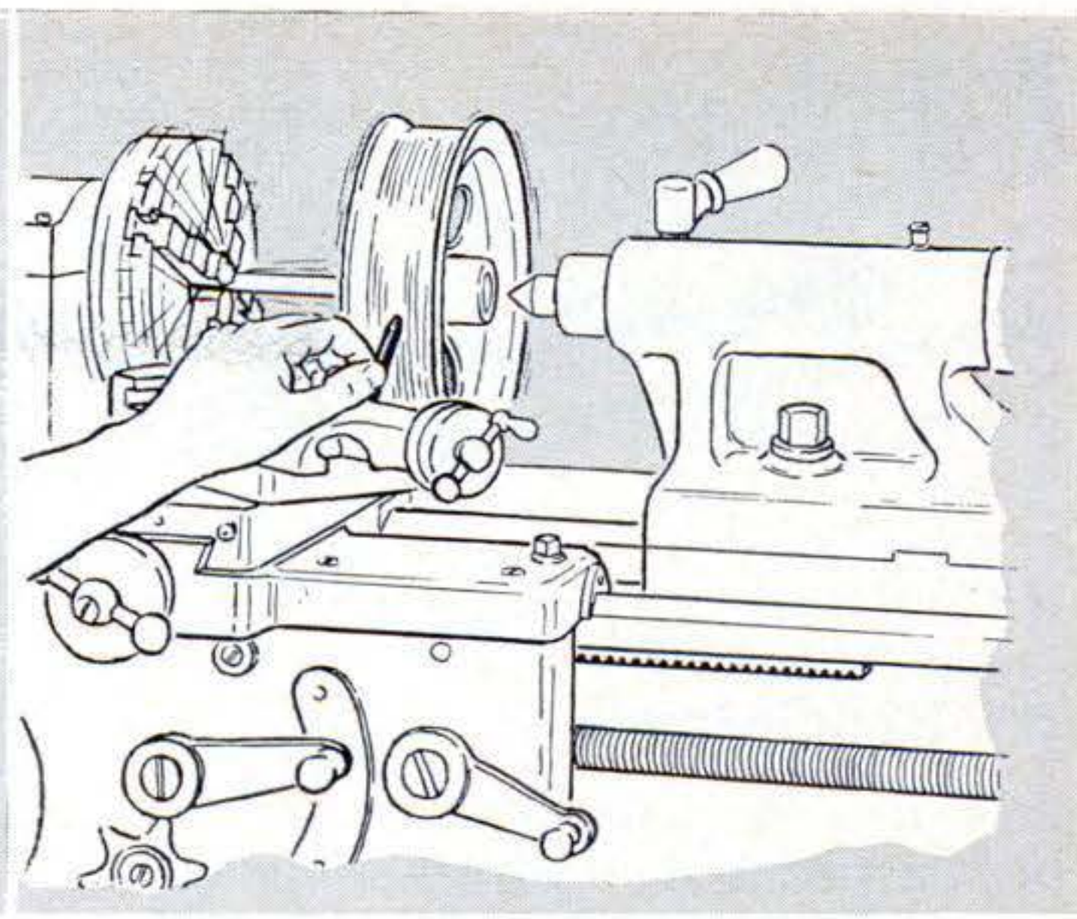


WAND IS CHUCKED TRUE, then face and rim of pulley are made to run true by bending the wand slightly, as needed. Use a dial indicator



and turn chuck slowly by hand. An unbalanced pulley will immediately run out when the tailstock center is backed off while lathe runs.

Precision Balancing

and repeat the entire operation. As you reduce the imbalance, you can increase the lathe speed. When the pulley seems to run perfectly true at top speed, chuck the wand farther away from the pulley for more and more sensitive indication.

Practically speaking, the perfection of balance you can achieve is limited only by your patience. The wood-shaper motor pulley shown in the photo was so grossly unbalanced that it shook the whole shaper. Less than an hour's work devoted to balancing it, using the method outlined, produced a pulley that is better balanced than the factory-balanced motor armature.—*J. Whitehill, Easton, Md.*

▶▶▶WHEN you are doing heavy drilling or reaming in the lathe, the taper sleeve will sometimes turn in the tailstock if it has no tang to lock it. I have found, when this happens, that chalking the sleeve will usually make it hold.—*Albert Levesque, Somerset, Mass.*

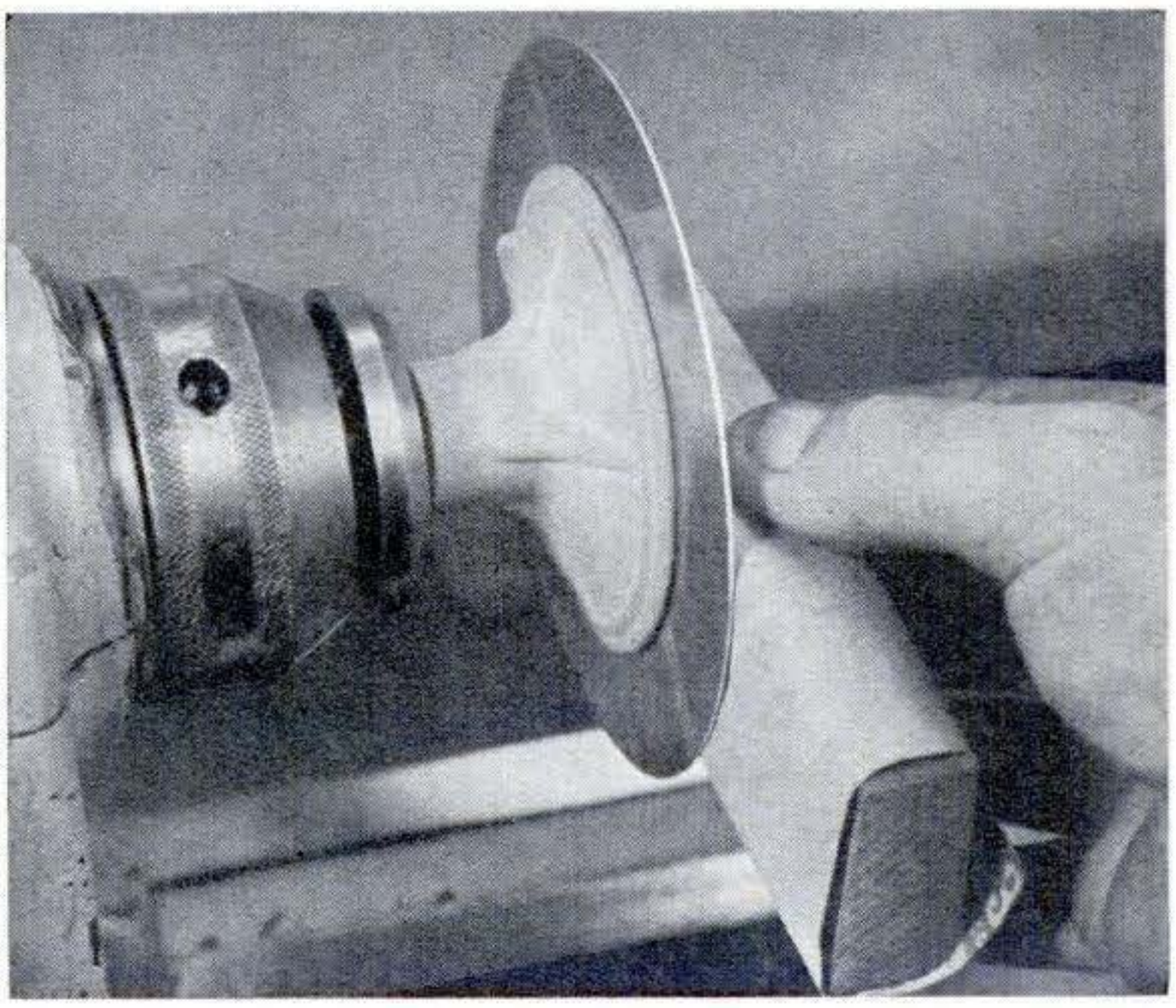
▶▶▶REMOVING an old roller-bearing outer race can be quite a problem if you can't get at it to drive it out. One man runs a bead around the race with an electric welder. When the welding bead cools, the cooling will usually shrink the race enough so that it falls out of place.

Suction Cup Holds Thin Work for Polishing

A LARGE rubber suction cup, like those used on car-top luggage carriers, makes an ideal chuck to hold thin disks for polishing in a lathe.

The steel nut embedded in the shank of the cup makes it easy to mount it. Cut the head off a bolt, or use a threaded stud, and screw it tightly into the nut. Chuck the protruding shank in the machine. Press the disk to be polished tightly against the suction cup so that it will be gripped securely.

Abrasive cloth or paper wrapped around a block and held against the rotating disk quickly polishes it.—*H. J. Gerber, Stillwater, Okla.*



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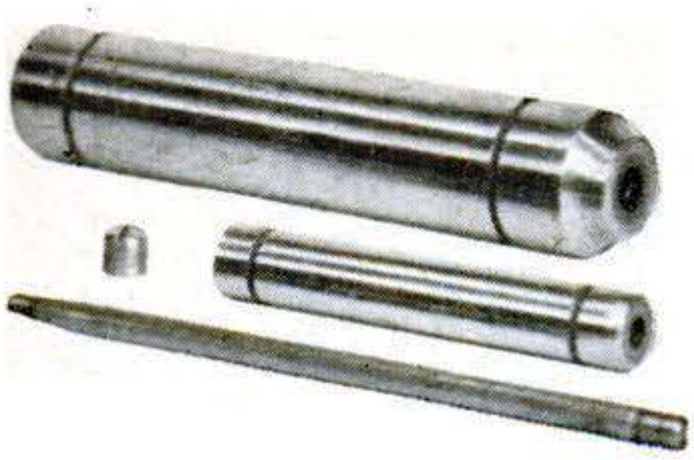
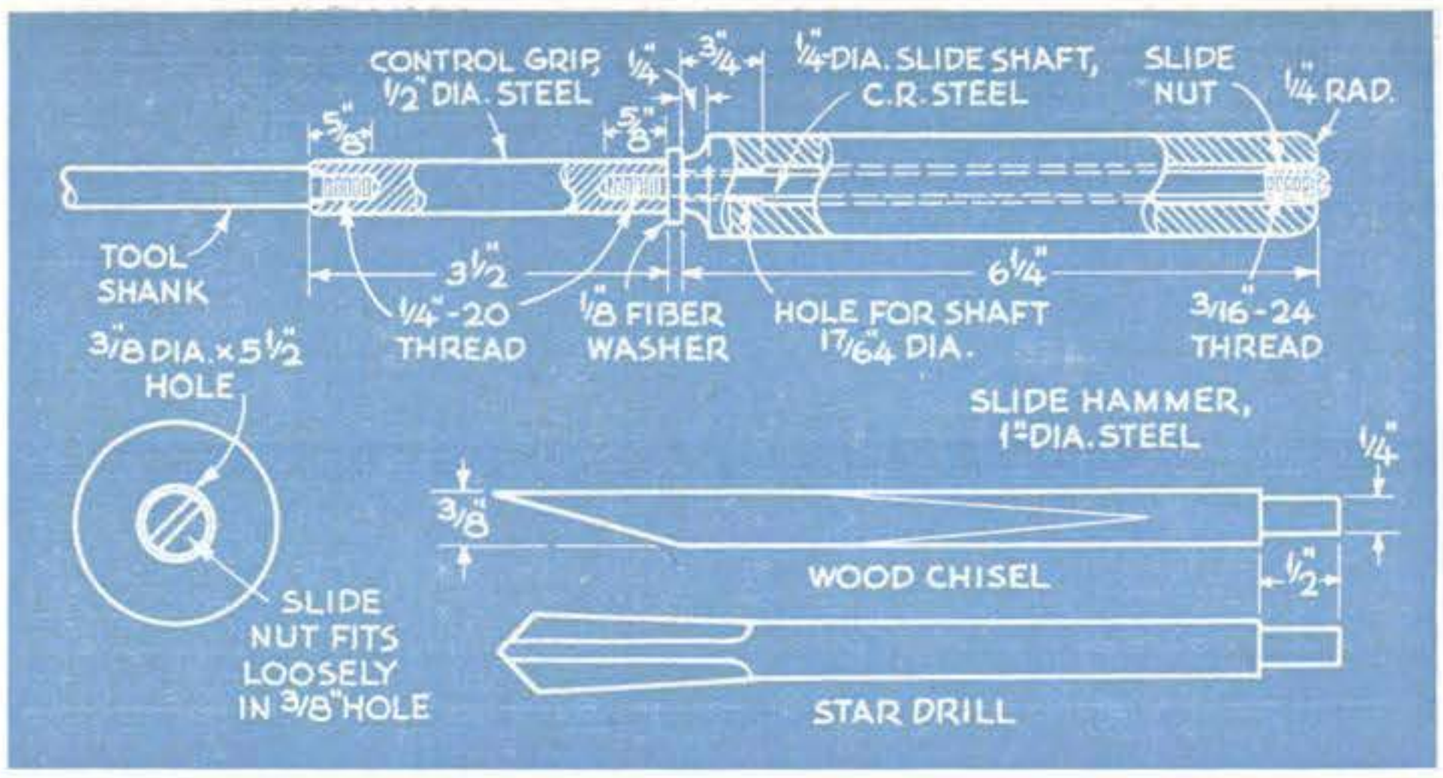


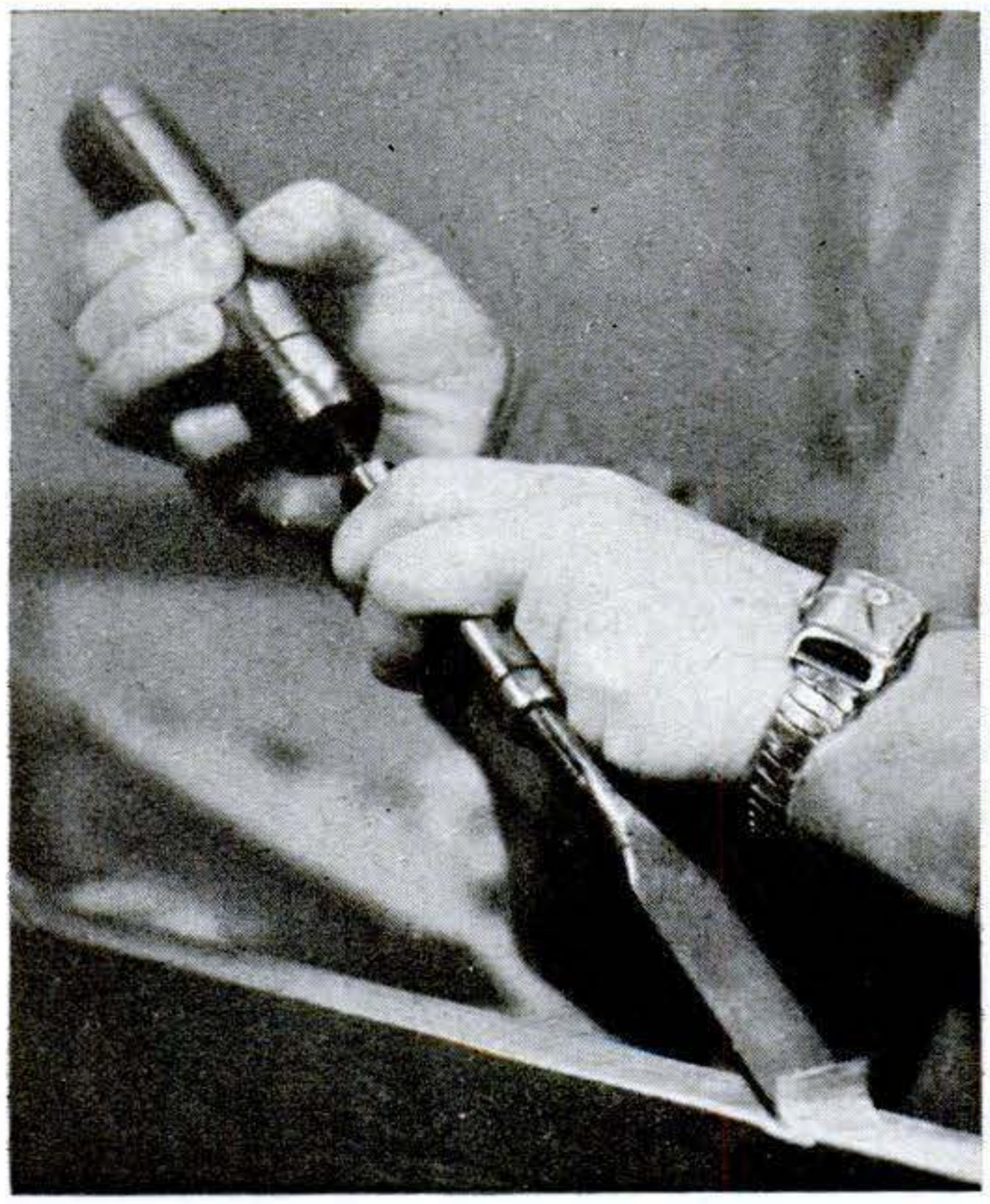


Slide Hammer Gives Power with Precision

INSPIRED by a familiar shipping-room tool designed for pulling nails from crates, this easily made tool can be used to deliver delicate taps for precise chiseling, or vigorous blows for drilling in concrete.

The sliding hammer head is made captive on the slide shaft by a shouldered guide hole and retaining nut. Make the hole through the hammer head by first drilling all the way through with a 17/64" drill, then reaming from the top end with a 3/8" drill. The rest of the construction is straightforward and apparent from the drawing.

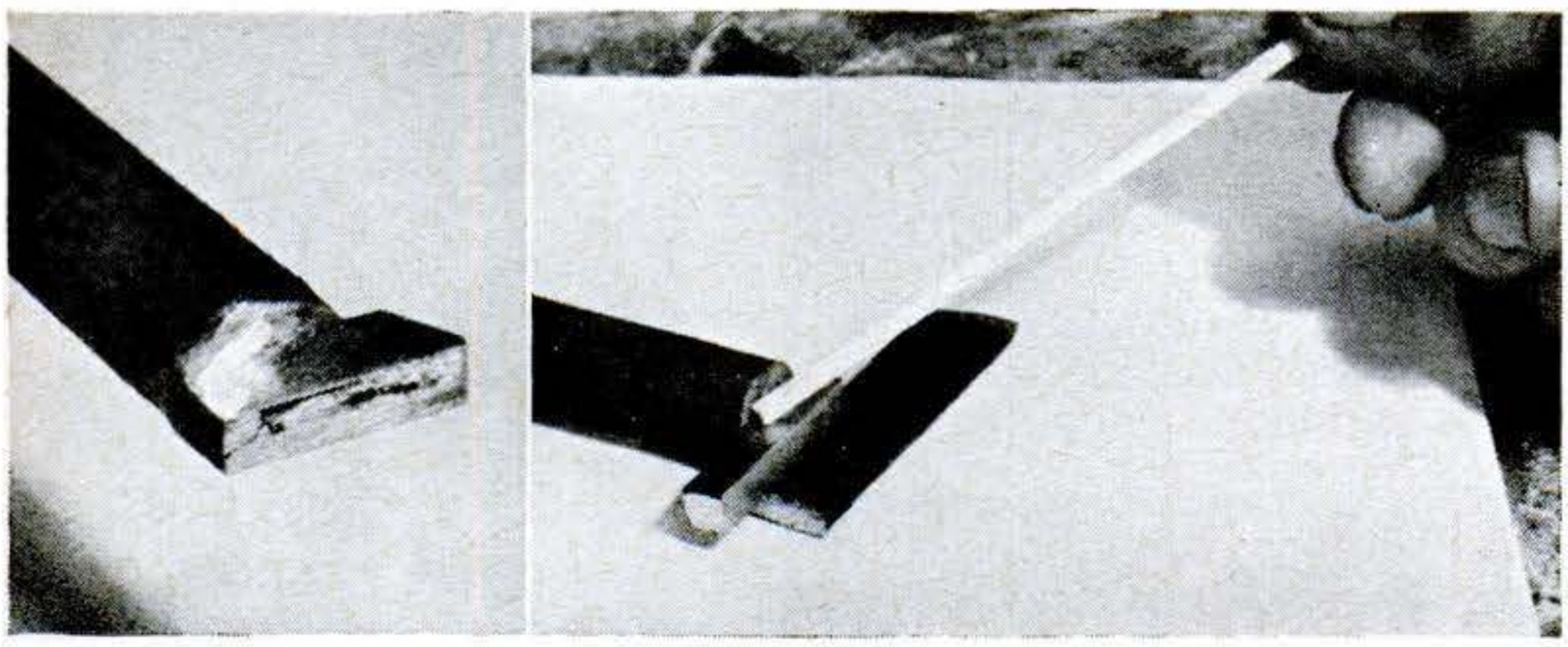
Standard hand tools are adapted for use with the hammer by turning down the shanks on the lathe and threading them to fit the hammer chuck. Some of the more useful are star drills, wood chisels, cold chisels, nail sets, and center punches.—*T. E. Halldorson, Evanston, Ill.*



Short Ends of Lathe Bits Put to Good Use

THROWING away the short ends of high-speed lathe bits has always bothered me. Recently I had occasion to bore some holes too small in diameter for our smallest boring bar. I silver-soldered one of the discarded bits to the end of an Allen wrench, blocked up the improvised boring bar in the regular tool post, and bored the holes without difficulty. In fact, it worked so well we now use the same idea on our regular round boring bars. They are ideal for boring to a square face, or internal threading to a shoulder. We don't throw away short ends now.

I use a regular, coated, silver-alloy rod and keep a slight excess of acetylene in the flame. Both surfaces to be joined must be ground bright and clean. Use only enough heat to make the silver "wet" the surfaces to be joined. Allow to cool in the air. Do *not* quench in water or oil.—*W. C. Cheney, Seattle.*



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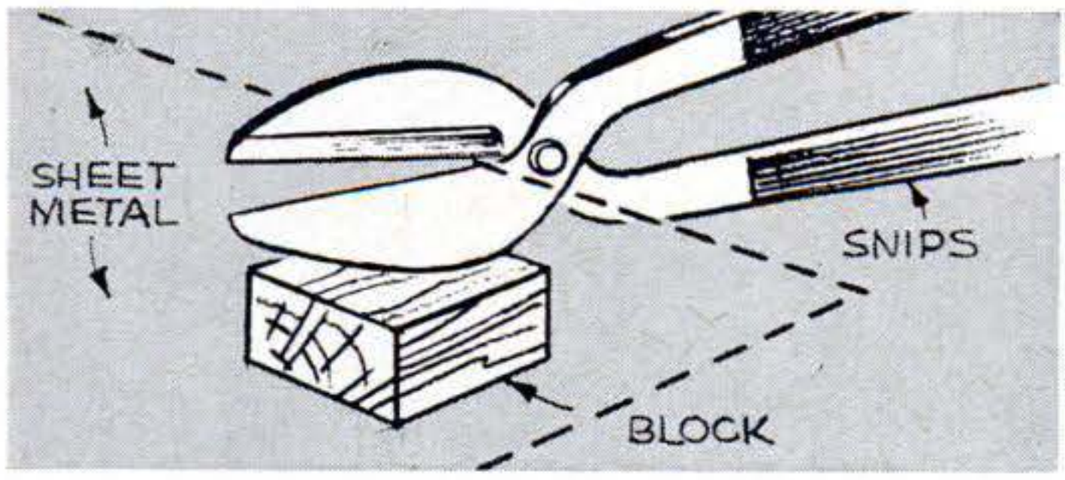
Short Cuts and Tips

FROM PS READERS

Holder for Acid Container

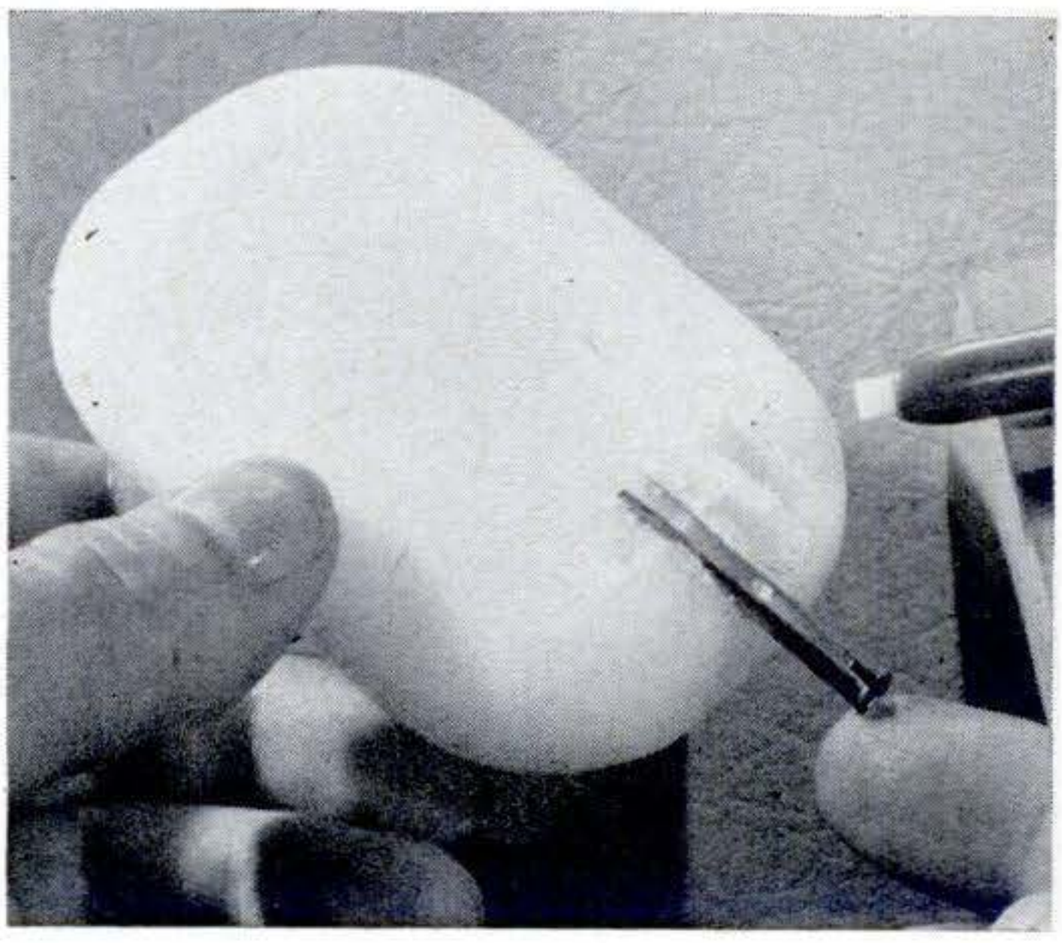
KNOCKING over a container of soldering acid can make a nasty mess. To make sure it doesn't happen, I set the container firmly in a coffee can partly filled with sand. For safety, I store my acid bottles on a shelf in the same way.—*A. A. Jagiellowicz, Ansonia, Conn.*

▶▶▶A COARSE hacksaw blade for bench use can be made from a length of metal-cutting bandsaw blade. Pin holes can be punched or drilled in the ends of a ½"-wide blade of six or eight teeth per inch. The blade saves a lot of work in hogging through machine and cold-rolled steel.—*John Henry, Pittsburgh.*



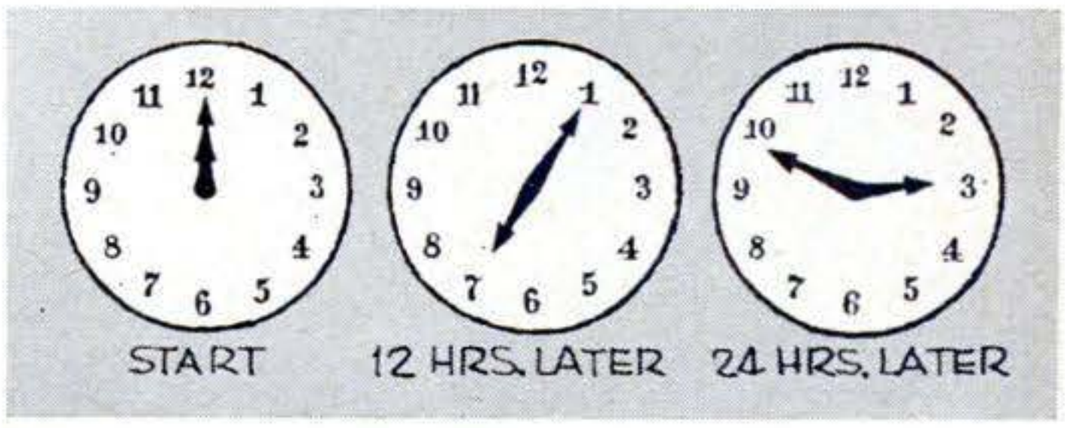
Aid for Sheet-Metal Cutting

SNIPPING sheet metal up to 16-gauge is easier if the cutting blades of the snips are raised above the bench on a block of wood. It prevents binding, and you can more readily use two hands to apply pressure when you need it on a tough cut.—*Jason Peak, San Francisco.*



Soap Used in Grease Pencil

ORDINARY soap works nicely as a temporary refill in a grease pencil. Merely force the empty sleeve into a bar of soap. When you replace the sleeve in the pencil, the soap will be propelled from the end in the same way as a regular filler.—*Martin Kearney, Los Angeles.*



Timing an Oil Burner

AFTER changing the nozzle tip, I wanted to know how long my oil burner ran during a 24-hour period. I hooked an electric outlet to the motor leads and plugged in a self-starting electric clock. Each time the control system turned on the burner, it also started the clock. When the burner was turned off, the clock stopped. I set the clock for midnight and checked it 12 hours later. It registered 7:05; the burner had run seven hours and five minutes during the night. A full 24 hours after the first setting the clock read 2:48. This told me at a glance that the oil burner had operated 14 hours and 28 minutes during the previous 24 hours.—*C. H. Shedlock, Trenton, N. J.*

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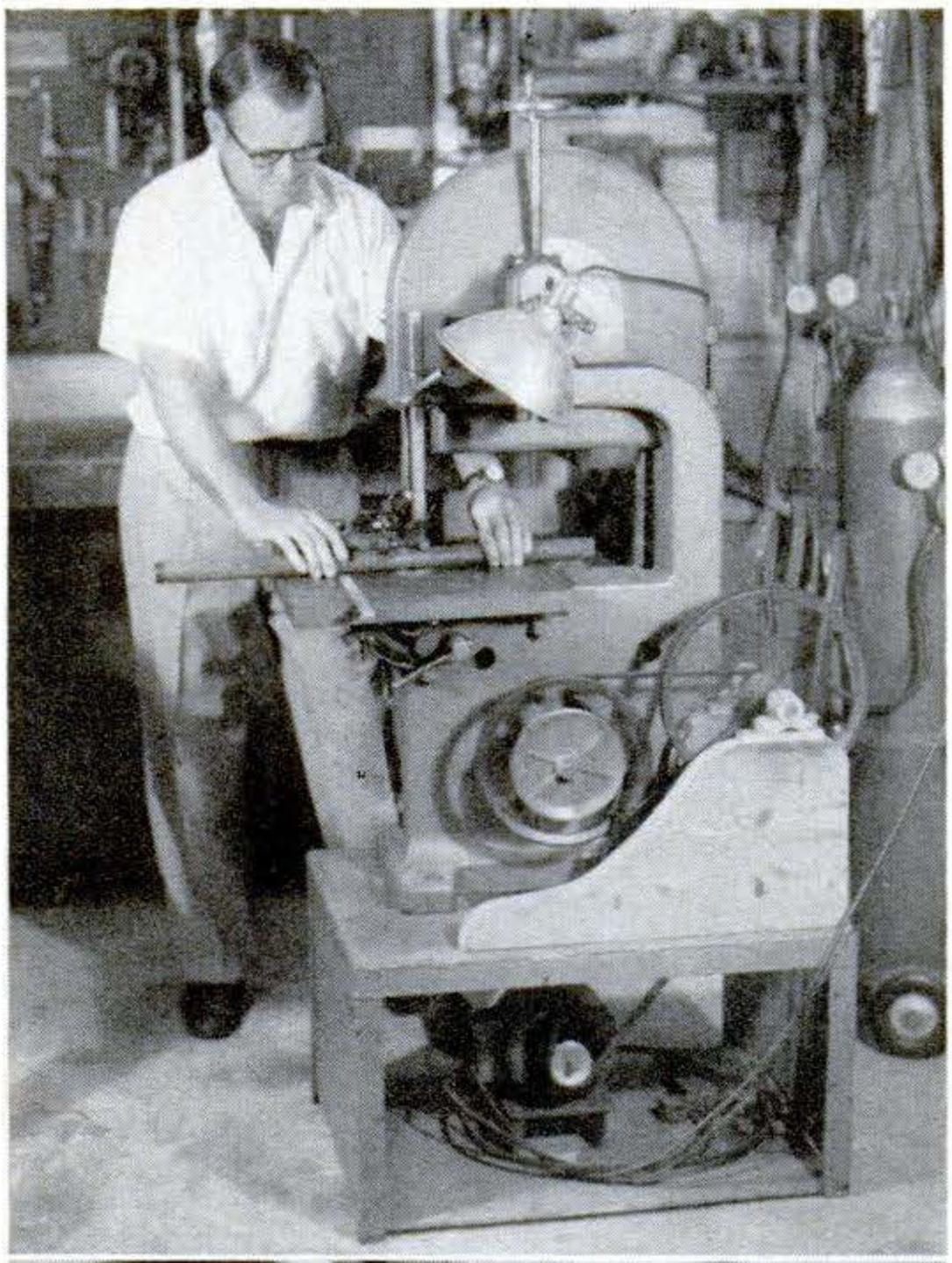
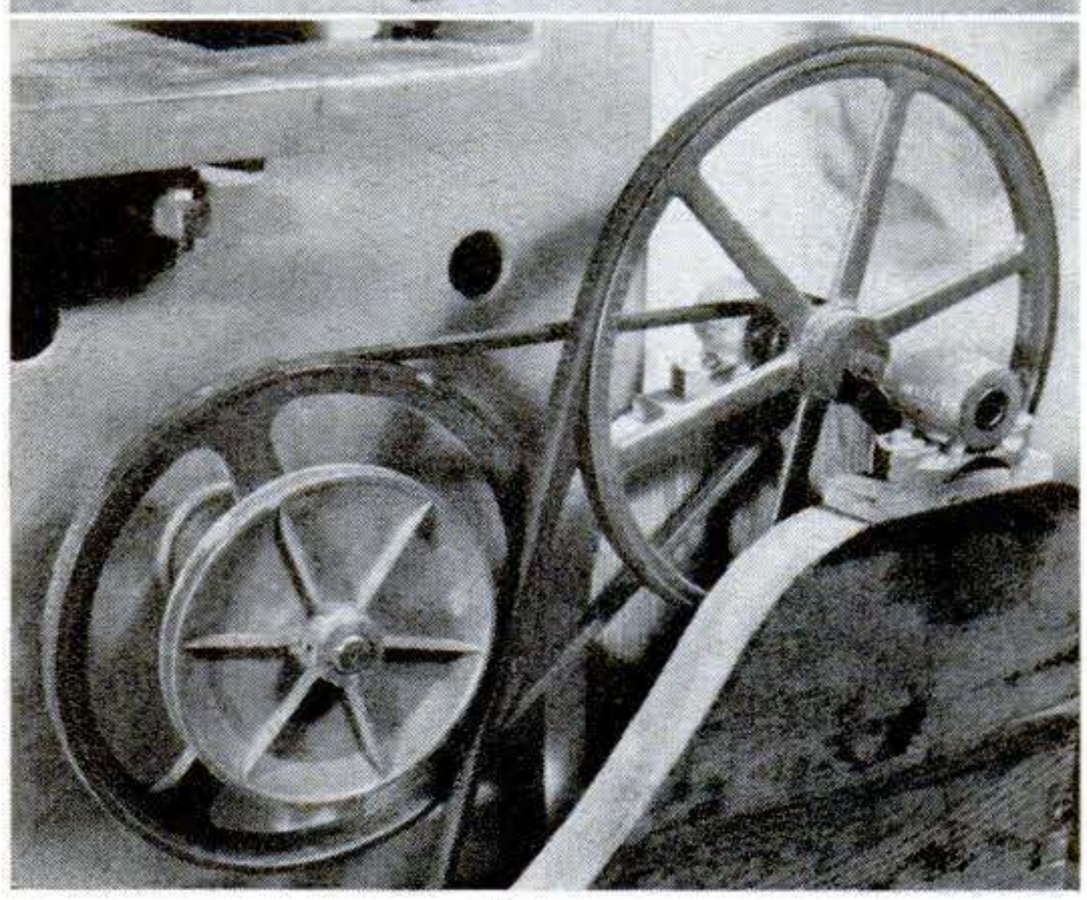
I Cut Metal with My Bandsaw





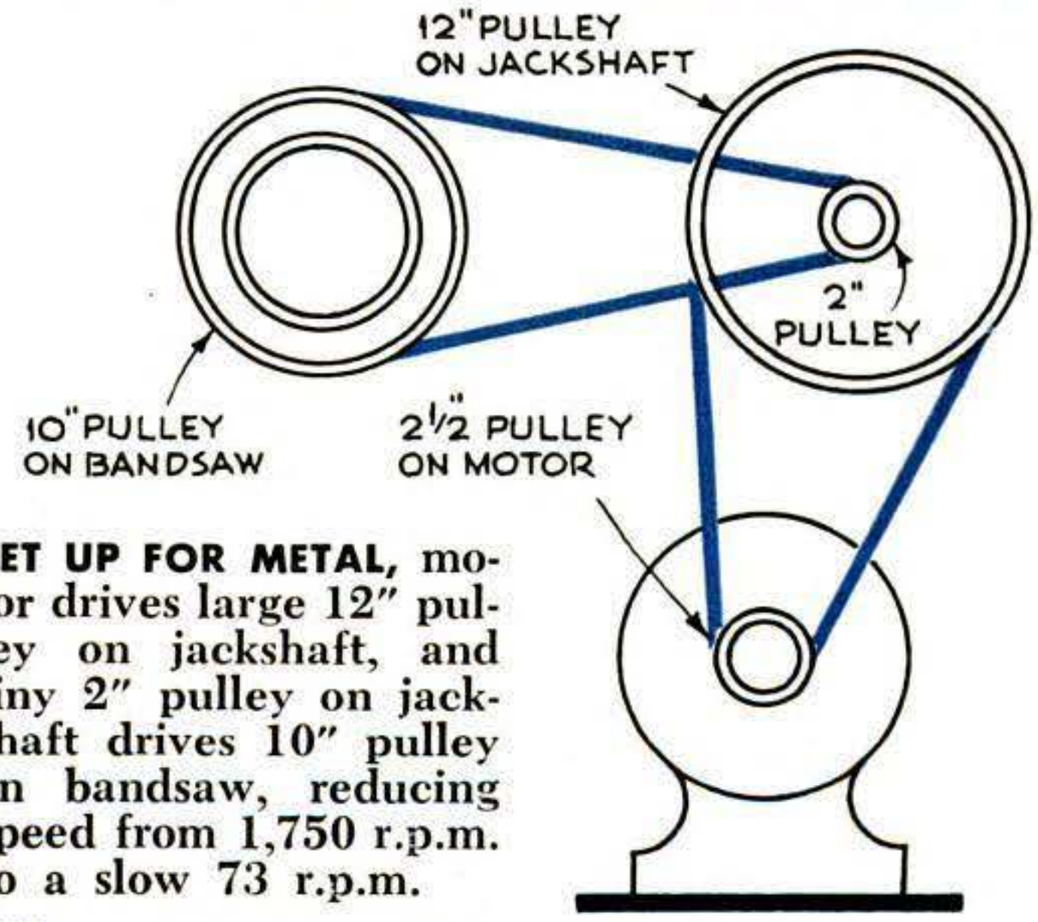
By Roland Loewen

A HOMEMADE speed reducer like the one I made will slow down an ordinary bandsaw so you can use a metal-cutting blade.

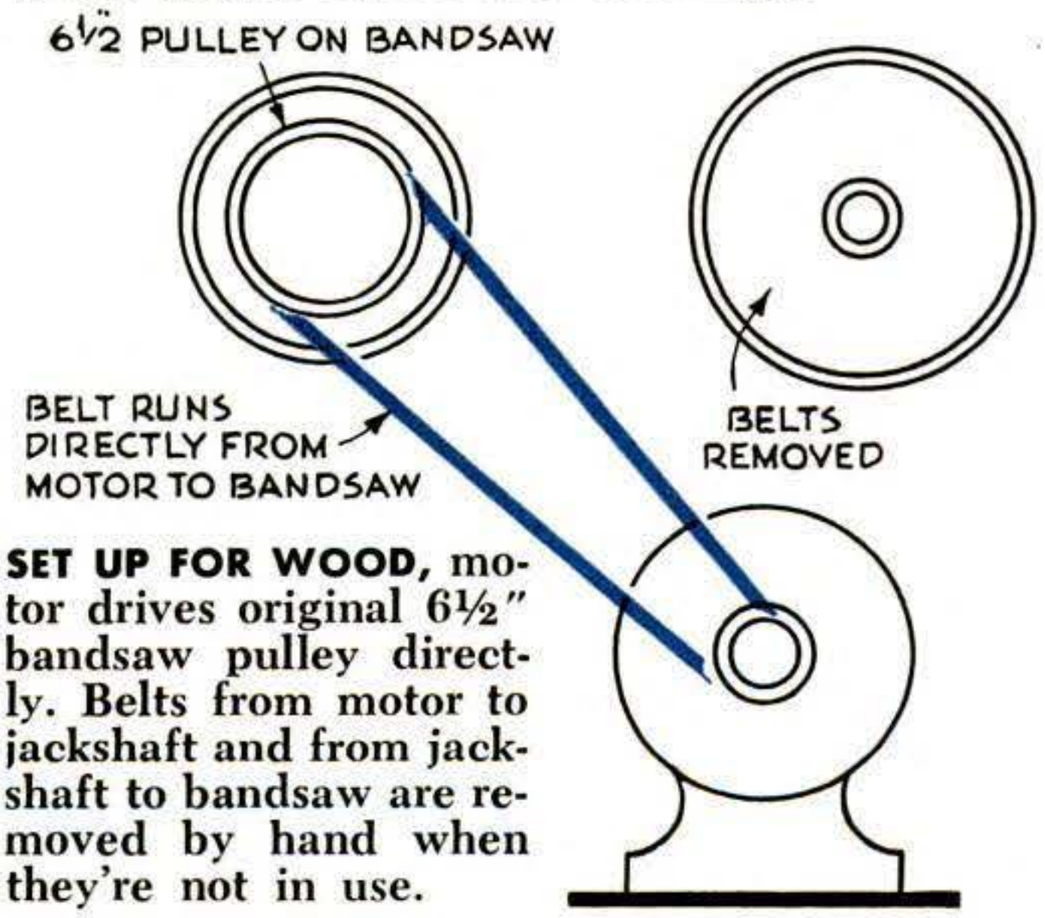
Without changing either the original motor or bandsaw pulleys, I simply mounted a jackshaft off to one side in pillow-block bearings on wood supports. For metal cutting, you need a blade speed of 280 to 300 feet per minute. On my 15″ bandsaw, this meant a final drive speed of about 73 r.p.m.

I mounted a 12″ pulley—the largest practical diameter—on the jackshaft. With a 2½″ motor pulley, this reduced the original 1,750 r.p.m. to about 365 r.p.m. at the jackshaft. I then figured I needed another reduction of about one to five, so I mounted a 2″ pulley on the jackshaft, and a 10″ pulley on the bandsaw. The result is very close to the required speed.

The same arrangement can be used for a 12″ bandsaw except that the 12″ jackshaft pulley should be reduced to 10″, giving a final speed of about 90 r.p.m. When the saw is used for wood cutting, I belt the motor directly to the original 6½″ pulley on the bandsaw, removing the belts to the jackshaft. Belt-tightening adjustments are made by moving the jackshaft bearings back and forth in their slotted mounting holes and inserting wood shims under the bearings.



SET UP FOR METAL, motor drives large 12″ pulley on jackshaft, and tiny 2″ pulley on jackshaft drives 10″ pulley on bandsaw, reducing speed from 1,750 r.p.m. to a slow 73 r.p.m.



SET UP FOR WOOD, motor drives original 6½″ bandsaw pulley directly. Belts from motor to jackshaft and from jackshaft to bandsaw are removed by hand when they're not in use.

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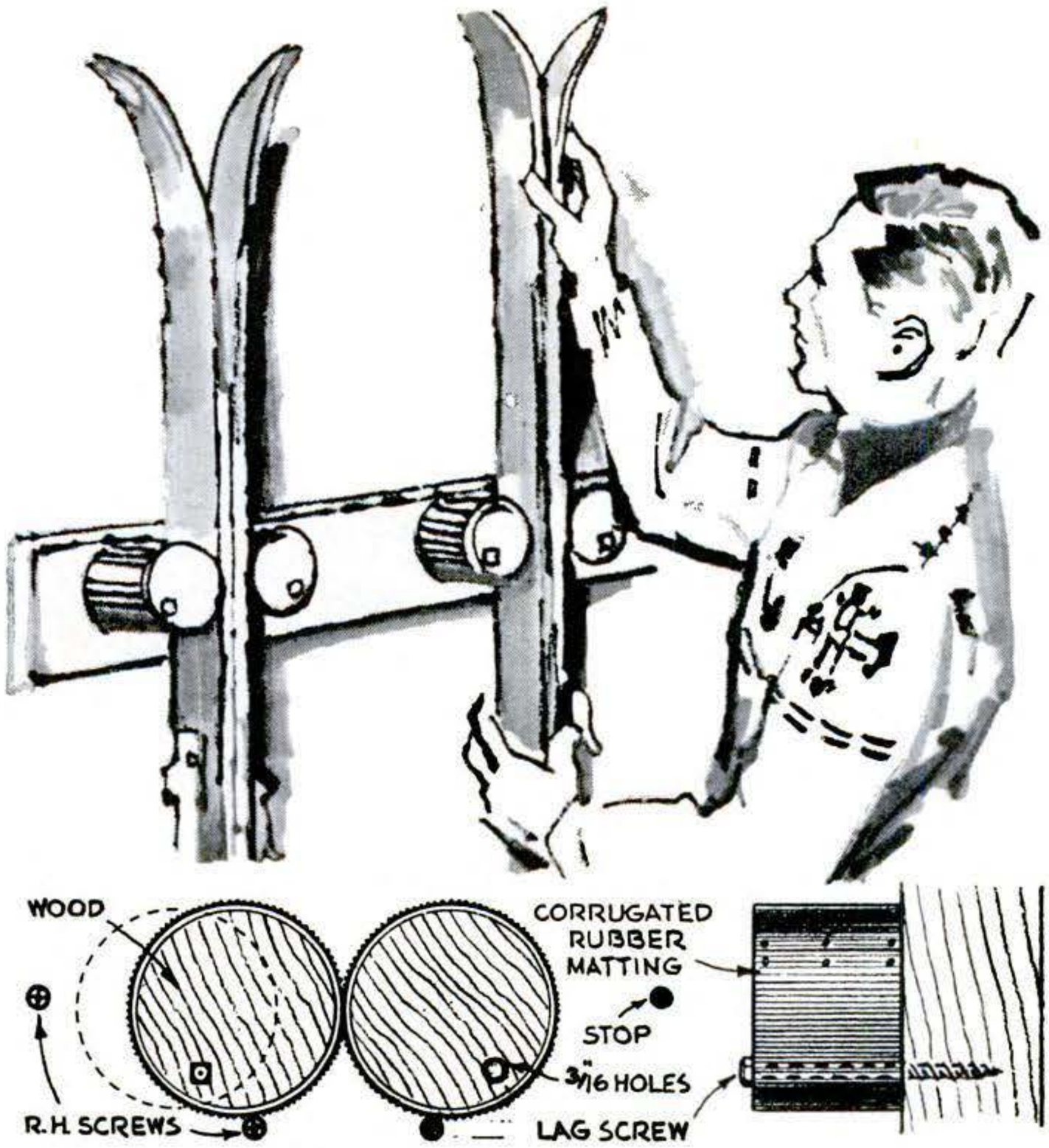
Short Cuts and Tips

FROM PS READERS

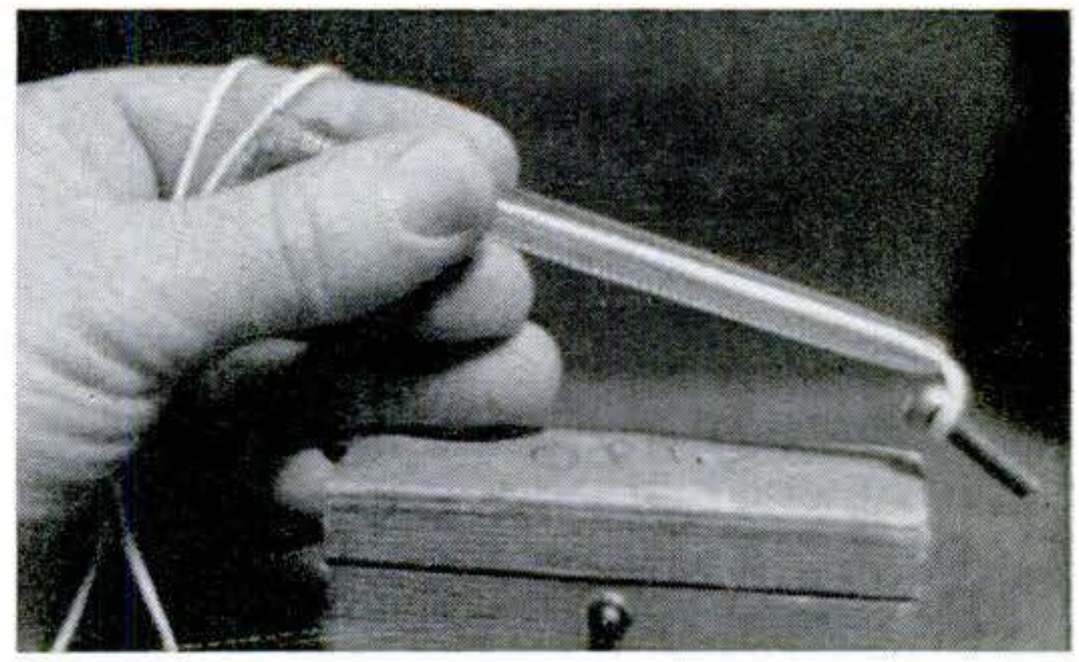


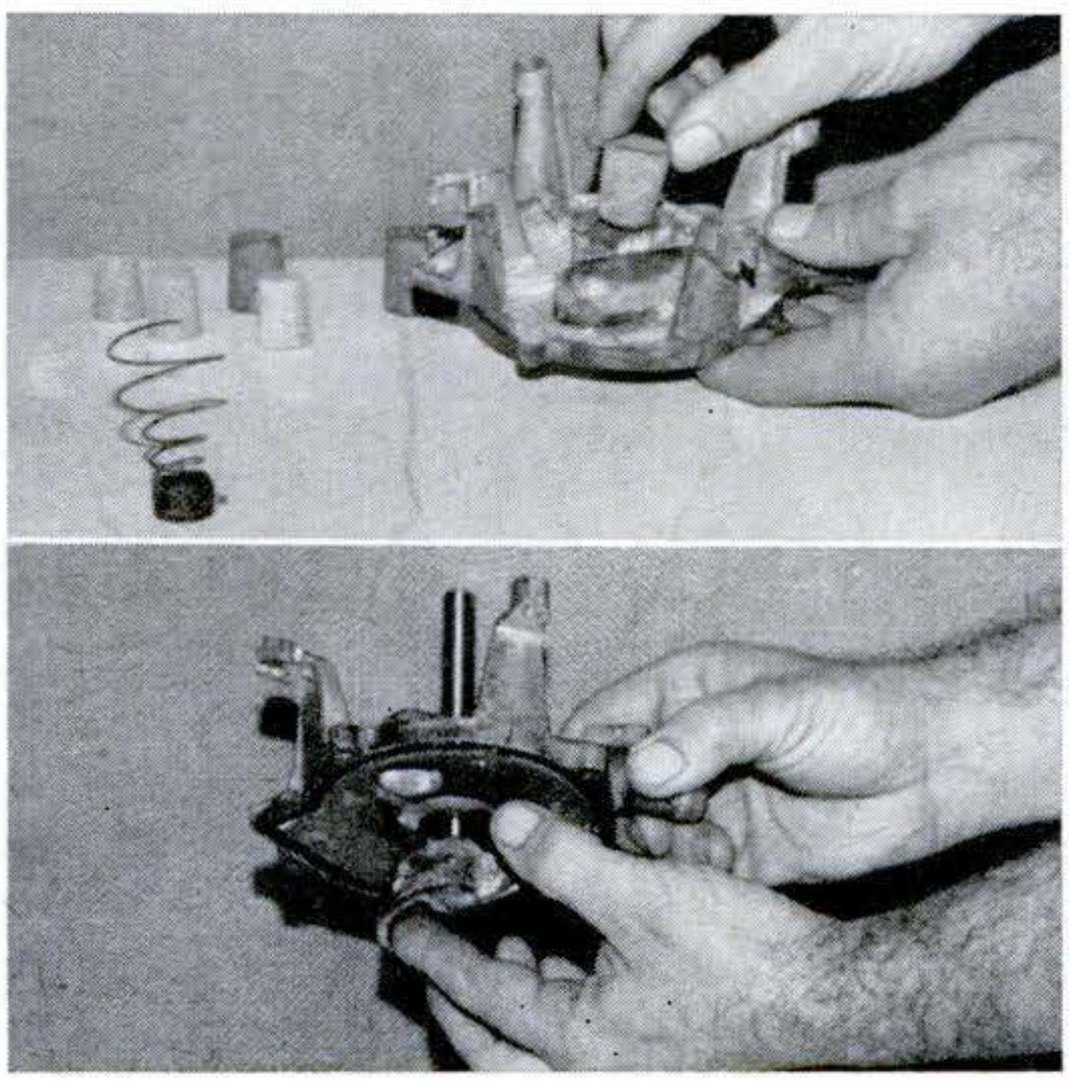
Easy-to-Make Ski Holder

STORING skis can be awkward. But not with this friction holder. For each set of skis, cover the rims of two pine cylinders, 3⅛″ in diameter and 3″ long, with corrugated rubber. Mount them with 5″ lag screws slightly off center, as shown. Roundhead wood-screw stops prevent the holders from swinging too far in either direction. When the skis are inserted, they'll be gripped firmly.—*Foster R. Freeman, Rocky Mountain National Park, Col.*

Thin Finger for Bolts

SCREWS or bolts sometimes need placing where there's no room for hands. But a long, thin finger can be rigged to do the job. Slip a loop of string through a piece of tubing. Then put the bolt or screw in the eye of the loop, and pull it tight against the end of the tube. When the bolt is in place, the string can be removed by pulling one end.—*Glen F. Stillwell, Manhattan Beach, Cal.*





Cork Bushing for Washer Pump

A CORK—the kind that stoppers bottles—makes a superior packing for washing-machine pumps. Usually these pumps have a graphite-asbestos packing. Trouble comes when the spring squeezing the packing rusts and loses its muscle.

Select a cork that isn't pitted, dead, or crumbling. It should be as long as packing and spring combined. Drill it lengthwise, $\frac{1}{32}$″ to $\frac{1}{16}$″ less than the diameter of the pump shaft. Then grind the outside to fit the pump.

Soak this bushing in grease. Discard the spring; the cork's resiliency will make up for it. Coat the pump shaft with grease, and reassemble the pump.—*Robert A. Brown, Shelbyville, Tenn.*

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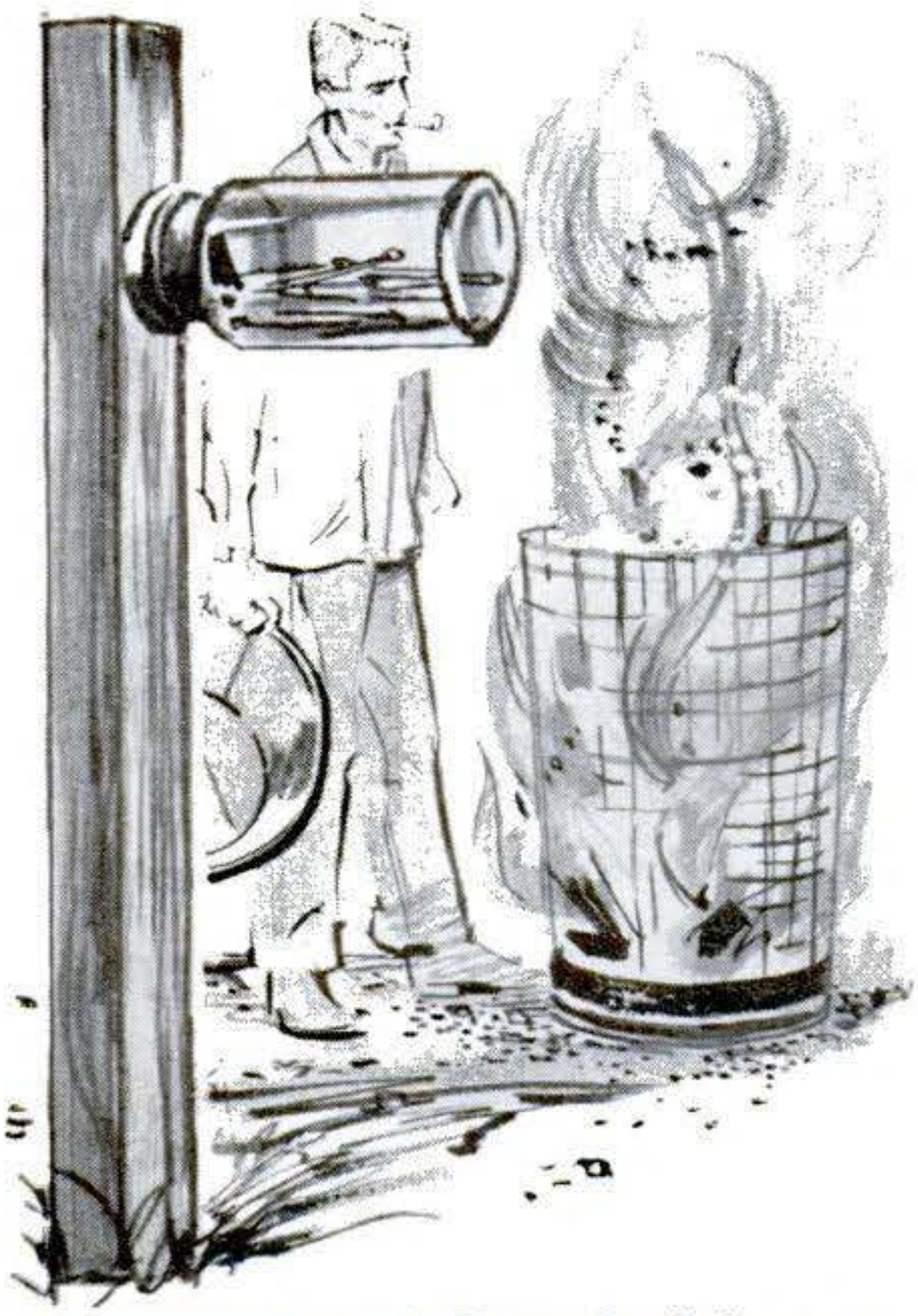


Storing Matches Outdoors

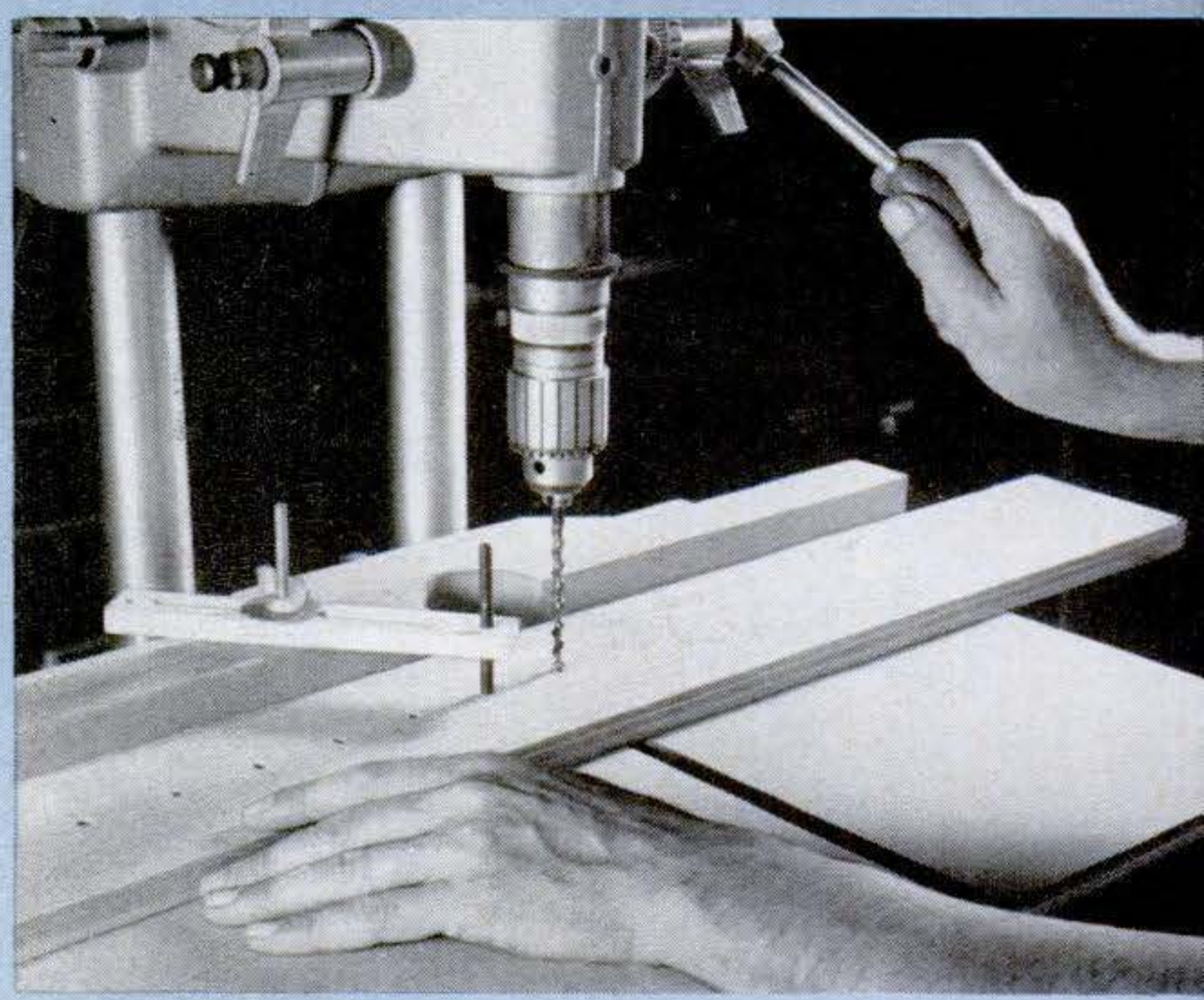
MATCHES for use at the outdoor incinerator can be kept dry and handy regardless of the weather. Place them in a small screw-top jar, the cover of which is fastened to the side of a stake. The jar is easily removed or rescrewed to its anchored lid.—*G. E. Hendrickson, Argyle, Wis.*

Plumb Bob from Nail Set

YOU can make an emergency plumb line from a nail set and a slip-on pencil eraser like that shown in the sketch at the left. Punch a hole in the eraser and thread through it a line with a knot at one end to keep it from pulling out. Then slip the eraser over the nail set.—*Victor H. Lamoy, Upper Jay, N. Y.*

▶▶▶LOCATE a drawer knob or pull about ½″ above the center of the drawer face. The knob will then appear centered to the eye that is looking down on it.

The jobs you can do



AUTOMATIC HOLE SPACING: There's no guesswork with this adjustable pin guide. As each hole is drilled, work is slid along fence until pin drops into it, exactly locating the next hole.

How to make a Jig-of-All-Jobs for a Drill Press

By R. J. De Cristoforo

IMAGINE a single jig for your drill press that combines in one handy form the best of all the special fixtures and accessories that let you do jobs otherwise impossible. Imagine shaping, routing, sanding, circle-cutting, drilling odd-shaped objects, and many other tasks—all performed on one table that need not be moved.

You can't buy such a jig anywhere, but you can make one over a weekend for three or four dollars. It saves fussing with a closetful of separate jigs that must be attached one at a time for each job. It speeds your work and makes it more accurate. What's more, it turns

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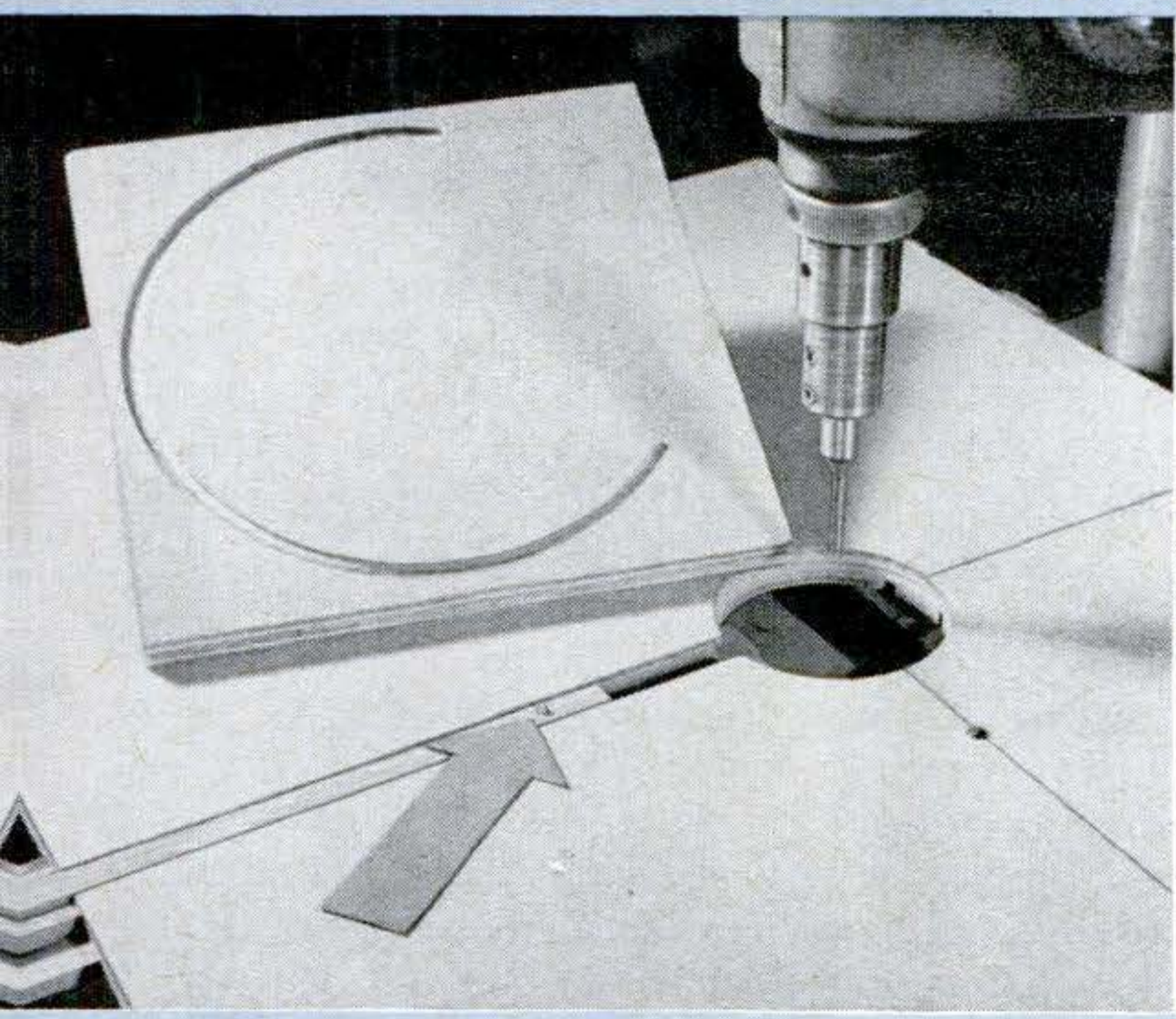
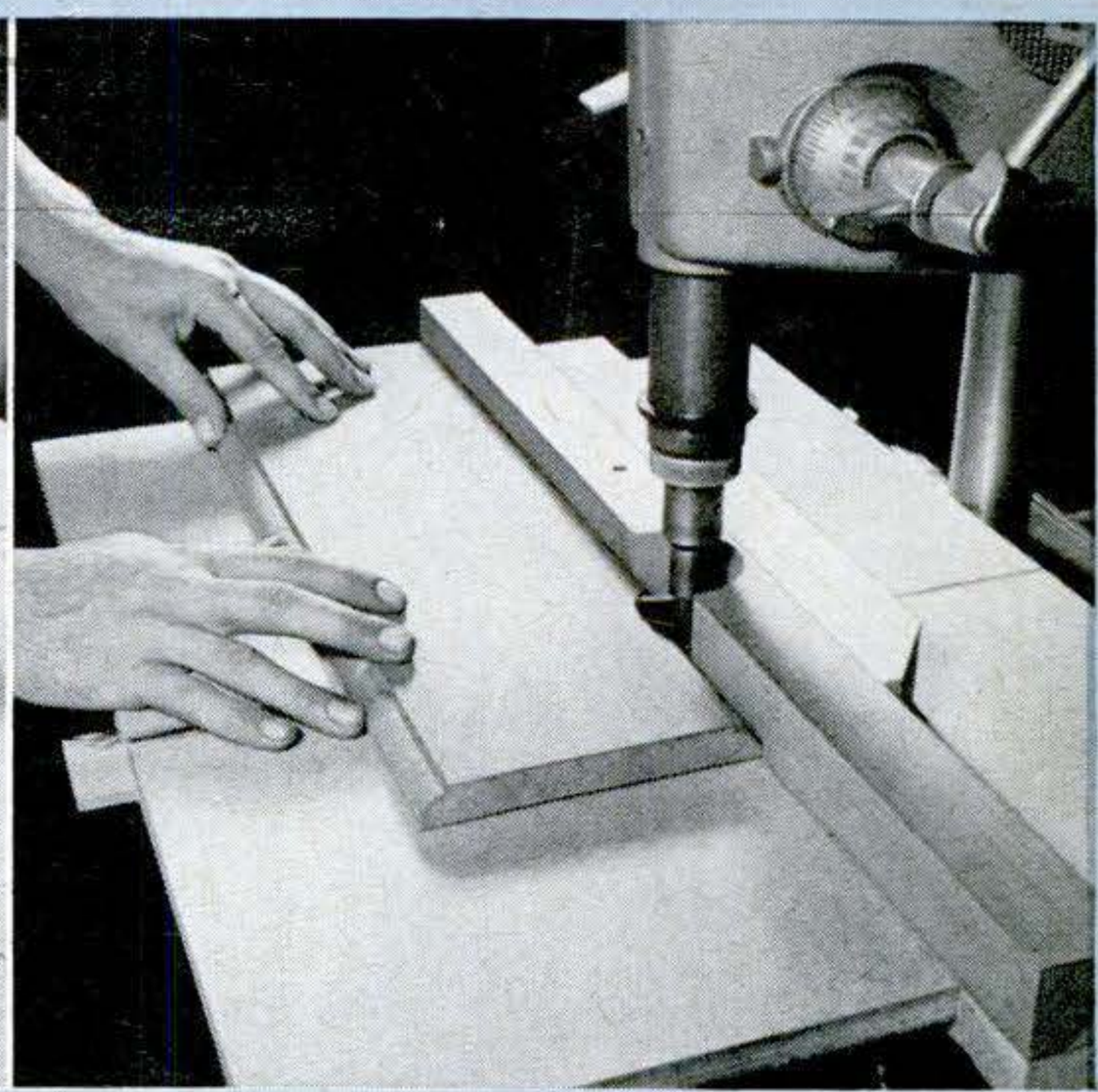
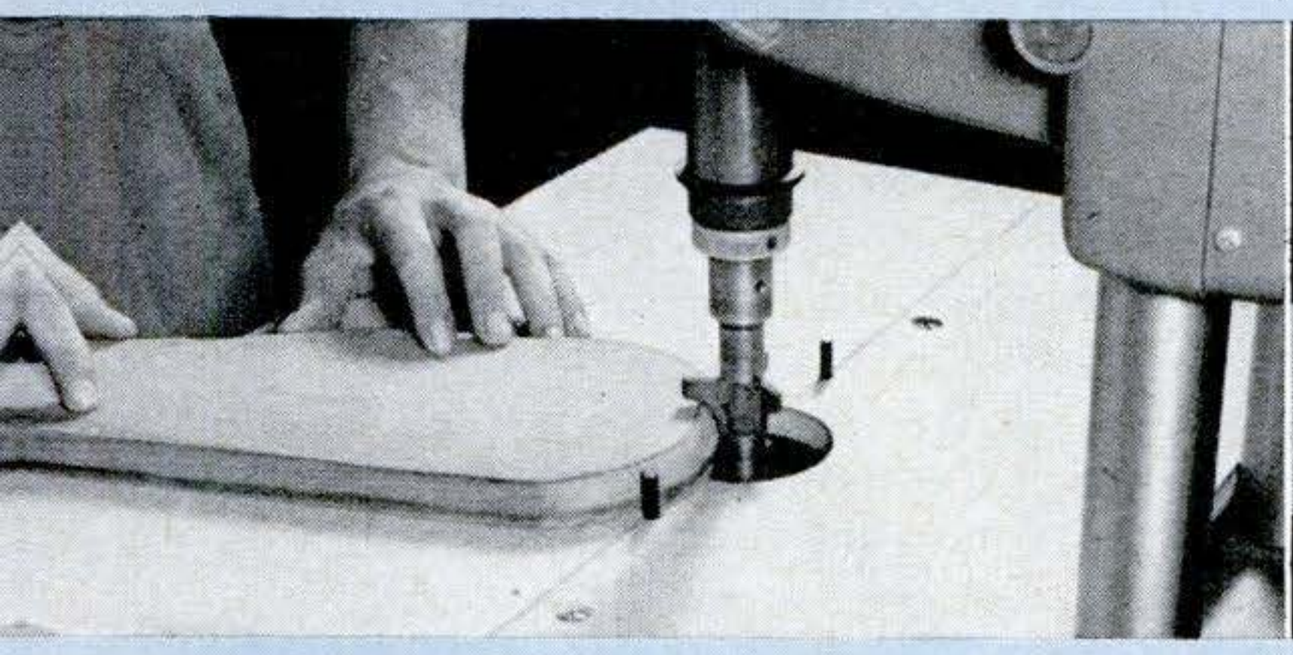
with the drill-press jig-of-all-jobs



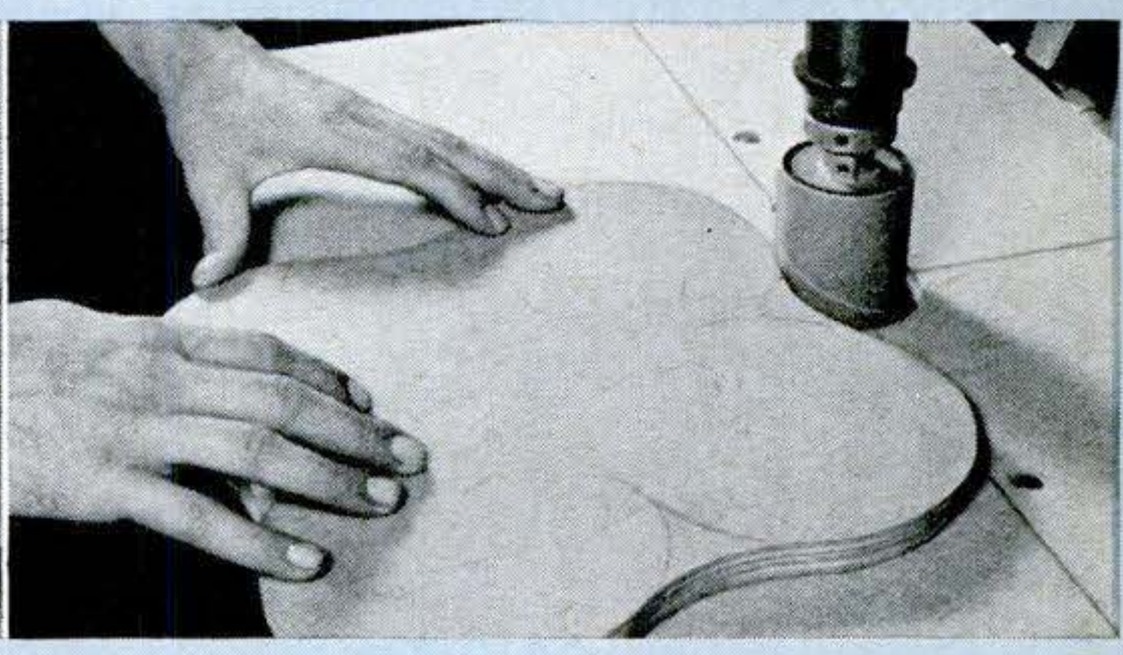
CIRCULAR ROUTING: Sliding pivot (arrow)—another built-in jig—makes perfect circles of any diameter. For large holes or disks, cut is made in easy stages right through work.



STRAIGHT SHAPING: Just slide the adjustable fence forward and you can accurately control cuts to any depth. If entire edge is removed, support work with shim after it passes cutters.

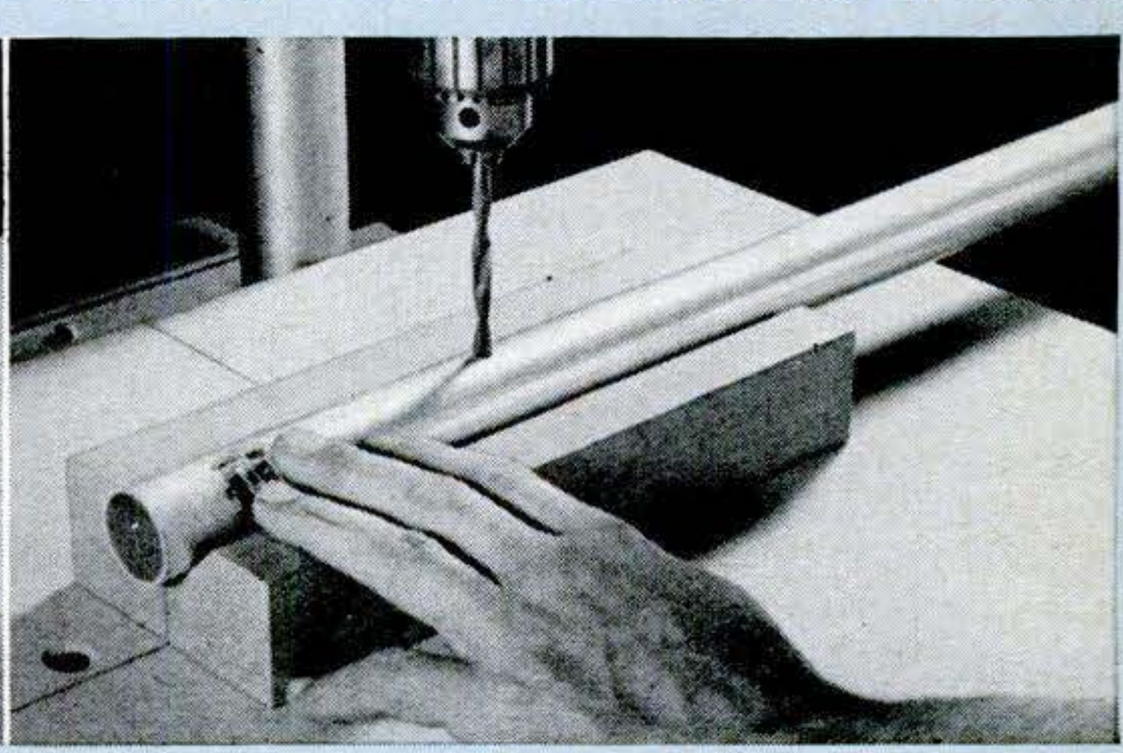


FREEHAND SHAPING: Irregular edges are shaped against these two removable pins that brace work as you feed it slowly into the cutters. Depth of the cut is controlled by the shaper collars.



FREEHAND SANDING: Hole in table permits drum sander to drop right through to any depth. If iron table below won't let drum pass through, block up work to reach upper half of sander.

PATTERN SANDING: Disk dropped into hole in table is same size as sander. Pattern to be copied (lower piece at left) bears against the disk until the upper piece exactly matches it.



DRILLING ROUND STOCK: V block slips quickly over two locating pins, automatically lining it up so that tubes and cylinders, regardless of size, are exactly centered under the drill.

CONTINUED

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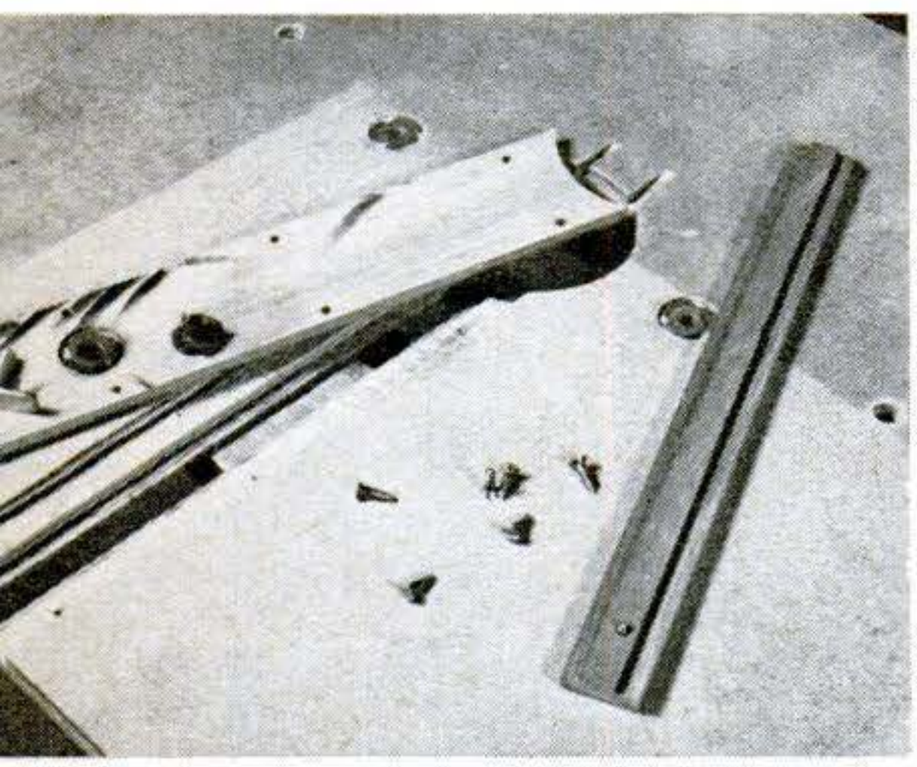
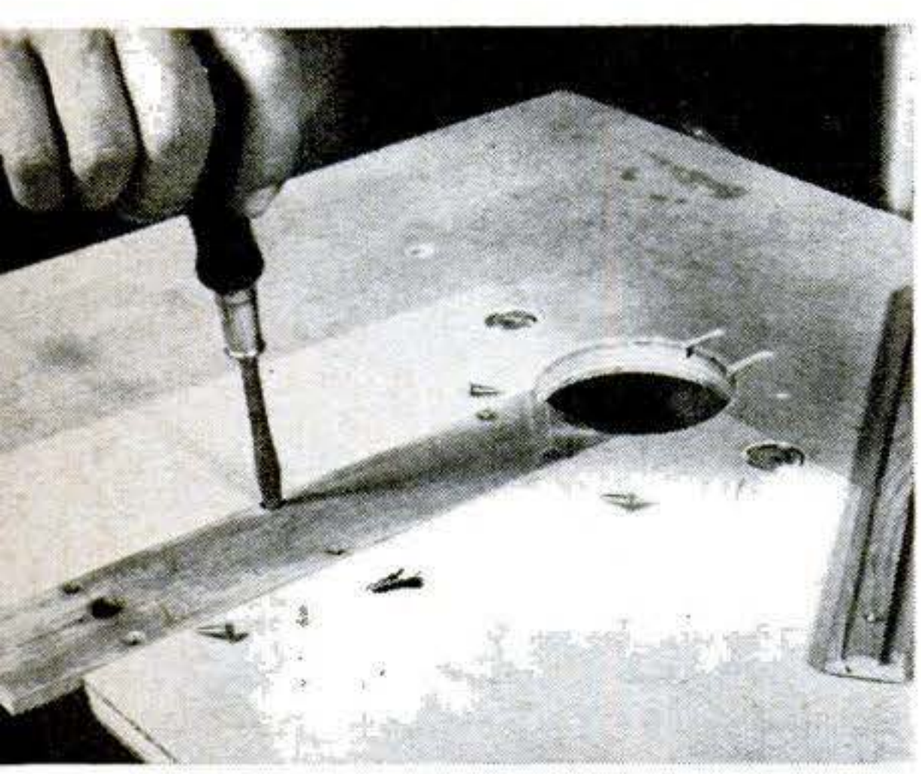
ATTACH NEW TABLE to metal one by means of existing holes. For a precise fit where no threaded holes exist, drill and tap new holes.

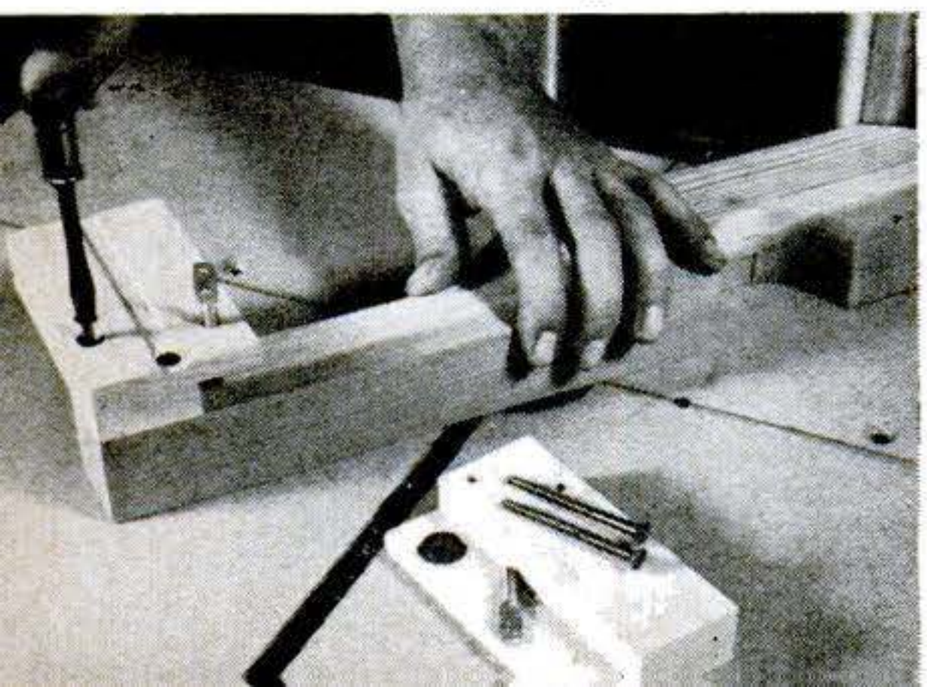


UNDERSIDE OF TABLE shows rabbeted grooves for pivot slide and flat strip that holds slide in. Note T nut used to hold lock screw.



MAPLE STRIP is screwed to bottom of table to hold slide in place. Use six ½" countersunk screws. Curve end of strip to match the hole.

SLIDING BASES are glued and screwed to fence. T nuts on inside of rabbeted lips hold bolts that lock the fence into position.



your drill press—essentially a metalworking machine—into a versatile woodworking tool.

What the table does. It provides a good-size platform for your work—a big help no matter what the job. For drilling, the adjustable lock-on fence accurately positions work for correct edge distance.

Where you need a lot of equally spaced holes, the overhead pin guide automatically spaces the holes for you. Unlike conventional fixed guides, this one is adjustable to various widths of work and distances between holes.

The fence is also used for straight shaping, routing, veining, surface fluting—in fact, for any operation where you need a straight guide adjustable to work size and spindle center.

Special sanding jobs. The center hole in the table lets you drum-sand irregular edges. To sand straight boards to exact width, you run them between drum and fence, removing small amounts in successive passes.

Drop the special double-decker disk into the hole and you can do pattern sanding with the drum, a wonderful technique that easily makes exact duplicates of irregular shapes. Insert a similar disk but with a center pin in place of the upper disk and you can drill holes twice as deep as the maximum spindle stroke. You drill the work halfway through from one end, then flip it over on the pin and drill the other end. The two holes will line up exactly.

Two removable pins in the table serve as guides against which you do freehand shaping of irregular or curved edges. Tricky drilling of round stock is made easy by a V block that drops quickly over the same two pins.

The ingenious pivot slide lets you do many jobs not usually possible on other tools. By rotating the work on the spindle, you can sand circles to exact size, rout circular grooves, shape curved edges, or cut circles or holes too large for other equipment.

Tips on construction. It can't be a haphazard job. Work slowly and carefully. Use a good grade of plywood for the platform. Hardboard-faced plywood was used on the one shown because of its smooth surface and durability. Maple or birch would be a good bet for the other parts.

Although the table shown here is mounted on a multipurpose tool, its basic design suits any drill press. Only the method of attachment may differ. On a multipurpose tool, the table can be screwed into the holes for the regular table insert. On a conventional drill press, use the method suggested in the drawing.

Laying out the jig. Once the table is locked in place, lower the quill with a small drill to make a fine hole. Through this hole draw two lines at right angles to each other, one from side to side and the other from front to back. These lines and the hole form the

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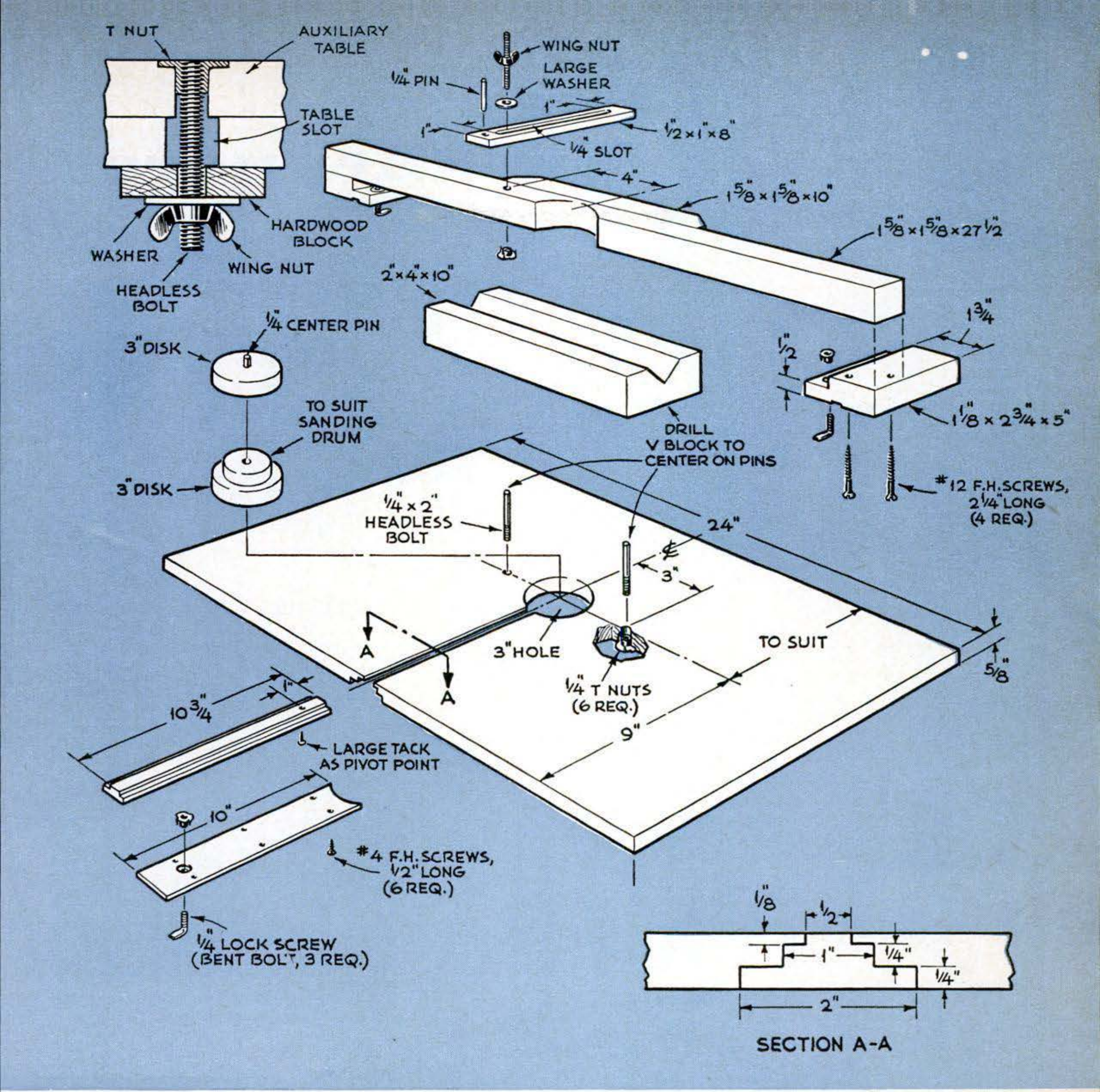

basis for laying out all the other jig parts.

To make the grooves for the pivot-point slide, first use a dado to cut a ½″ slot from the front of the table to the center hole. Then make two sets of rabbet cuts on each side of this slot as shown in the drawing.

A strip of maple ⅜″ thick and 1″ wide forms the slide itself and is shouldered to fit in the first set of rabbets in the table slot. A ¼″-thick strip of maple 2″ wide fits in the second set of rabbets to close the opening under the table. Fine-sand the slide to a snug sliding fit, and wax it.

Making the fence bases. These should be rabbeted to fit the table edge. Clamp the bases to the table, then cut the fence itself to fit. The half-hole in the fence is sized to allow clearance for your largest shaper cutter.

T nuts—those special threaded metal inserts—are used to provide threaded bearings for the lock screws that anchor the fence. T nuts are also used to anchor the lock screw in the pivot slide, the one in the pin guide, and the two pins in the table.

Two 45-degree cuts in a length of two-by-four will make the V block. Drill accurately the holes that locate the block over the pins. Protect the finished table and parts with wood sealer or shellac.

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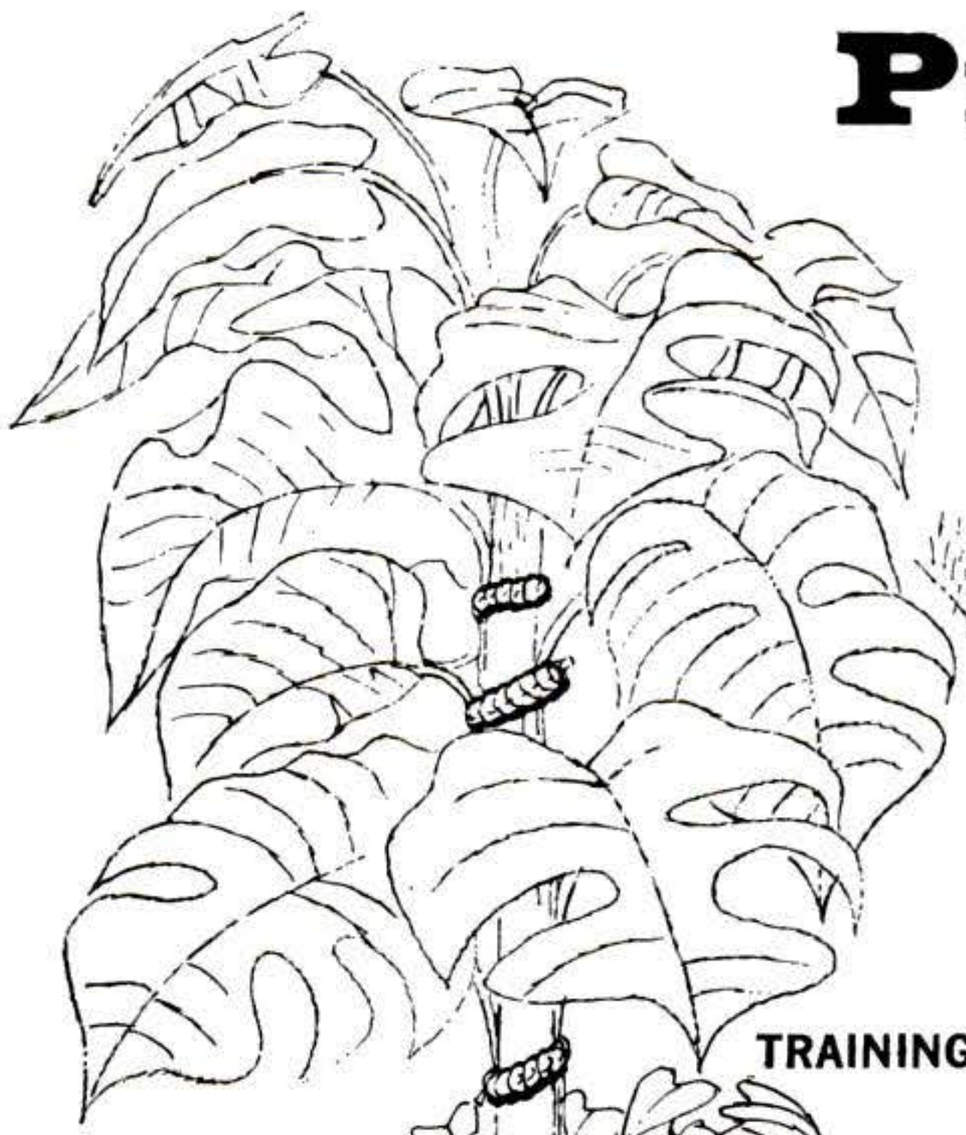
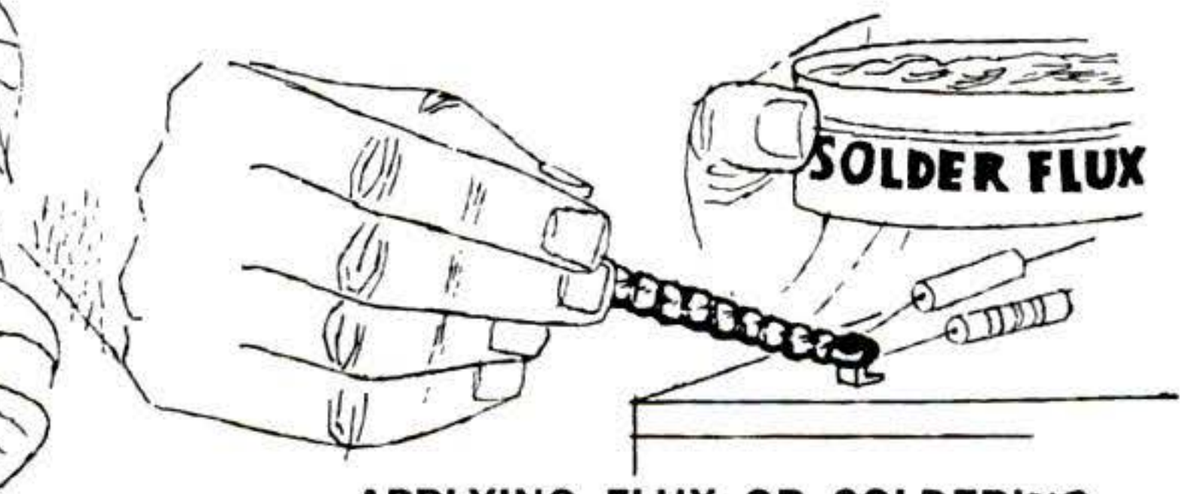
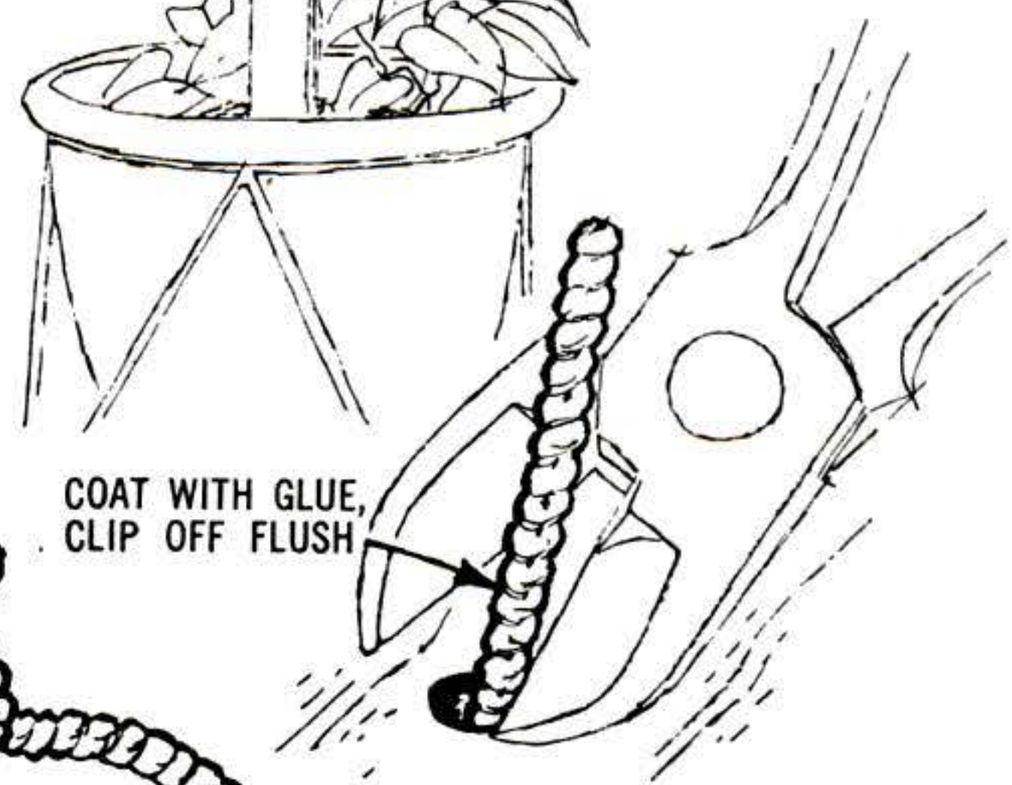
7 Uses for Pipe Cleaners





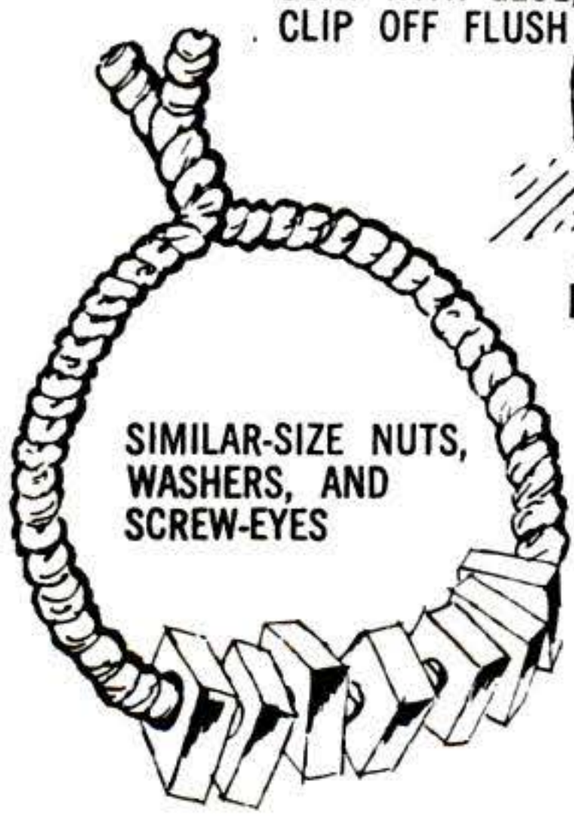
APPLYING FLUX OR SOLDERING COMPOUND

TRAINING PLANTS



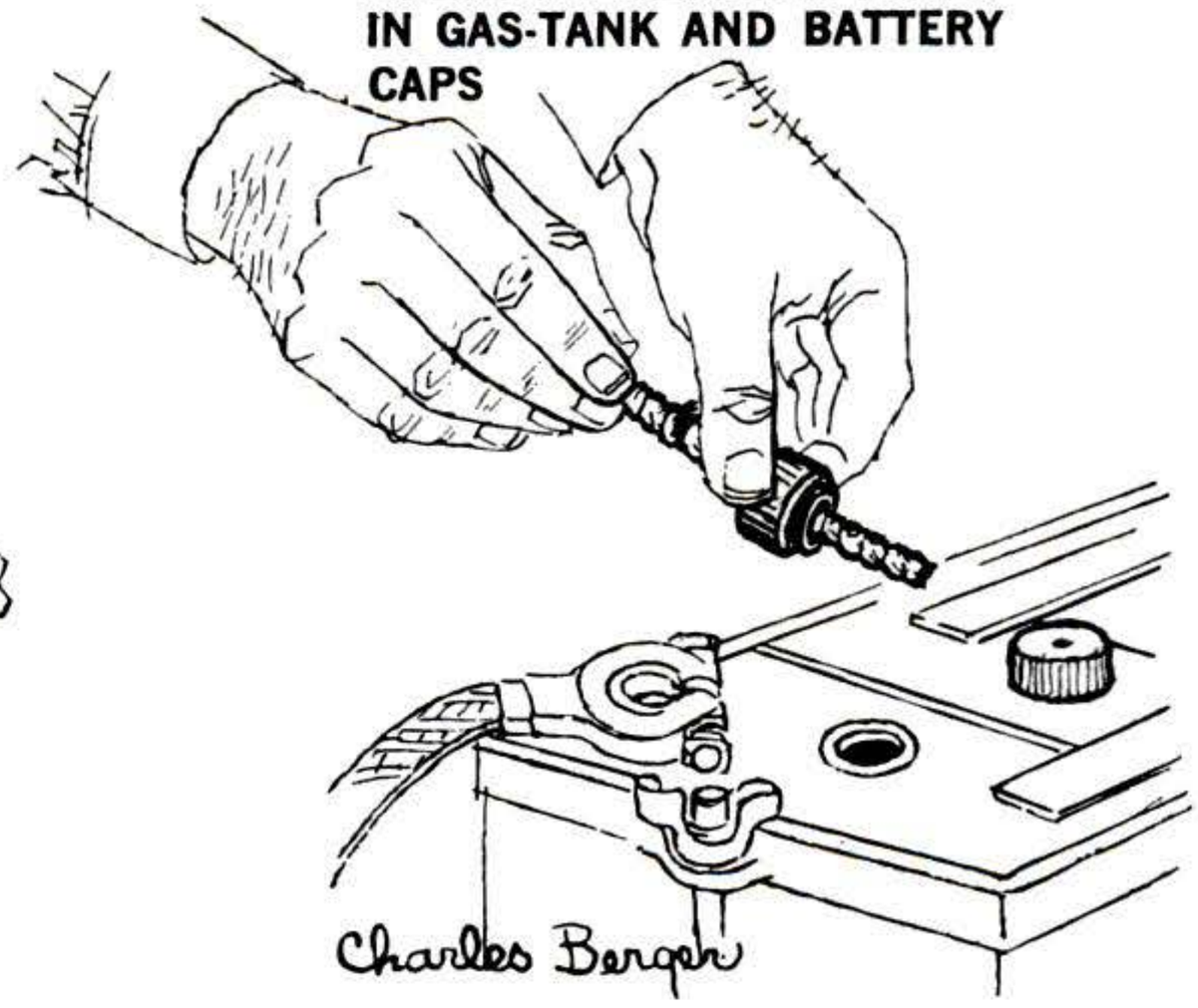
NEW GRIPS FOR WOOD SCREWS

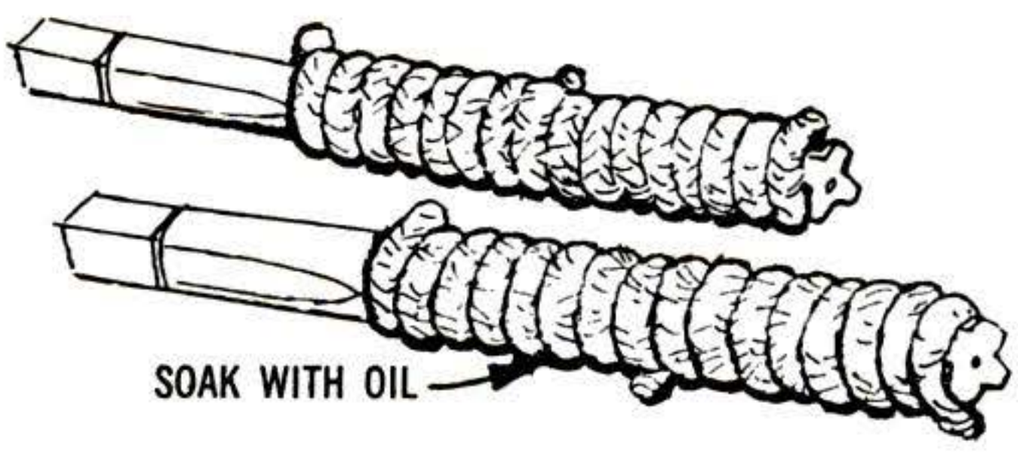
LUBRICATING LOCKS



SORTING SMALL PARTS

OPENING BREATHER HOLES IN GAS-TANK AND BATTERY CAPS





PROTECTING THREADS ON TAPS

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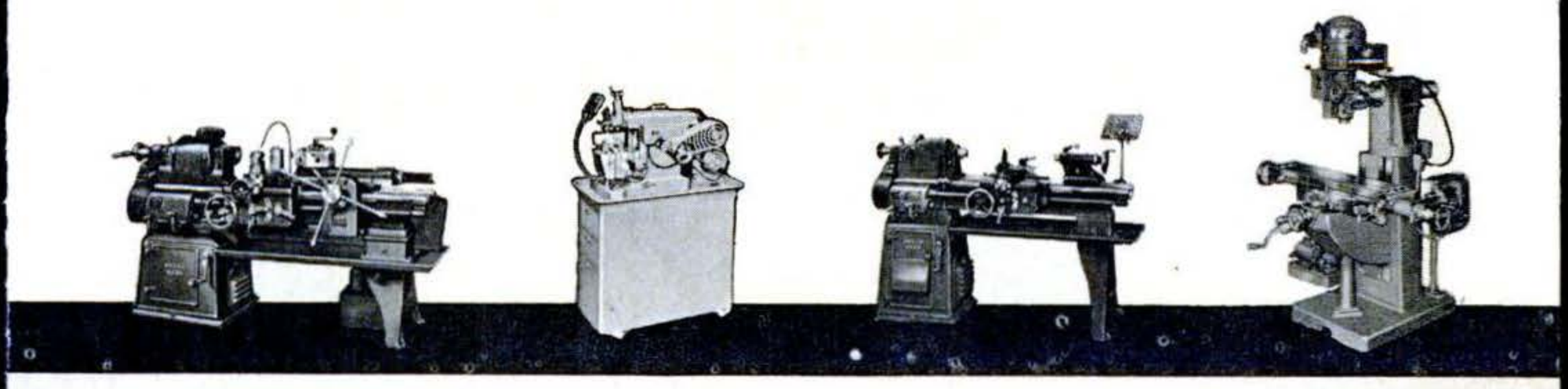
Machine Tools



FOR EFFICIENT • ACCURATE • DEPENDABLE MACHINING

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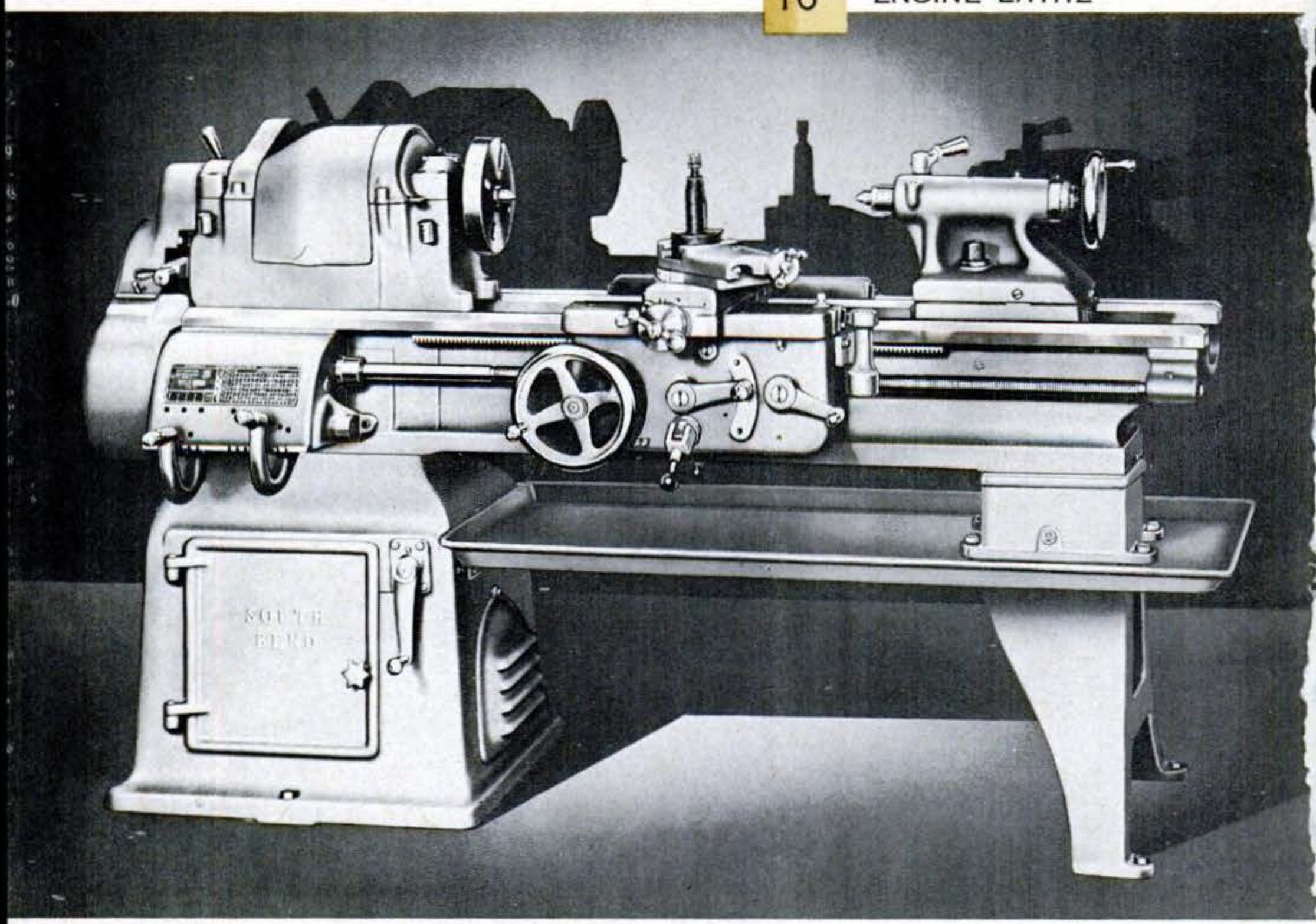
SOUTH BEND

10", 13", 14½", 16" & 16-24"

LATHES

16" ENGINE LATHE



Performance-packed Precision Lathes

For over a half-century South Bend Lathes have built a reputation for dependable, efficient machining. You'll find them everywhere—in factories, toolrooms, experimental shops, laboratories, maintenance and service shops around the world—everywhere that metal has to be turned accurately, smoothly and economically.

Here are a few of the things that contribute to the efficient, dependable performance of South Bend Lathes:

SMOOTH POWER. Smooth vibration-free power, so essential for precision operations, is made possible by the direct belt drive to the spindle. The high efficiency of this drive delivers more usable power. Back gears provide low speeds for heavy cuts.

SUPERFINISHED SPINDLE. Spindle bearing surfaces are hardened, ground and then superfinished to five microinches (.000005") r.m.s. Spindle runs in bronze bearings which are

TIME PAYMENT PLAN
3¼% interest on original unpaid balance per year—up to 36 months to pay.

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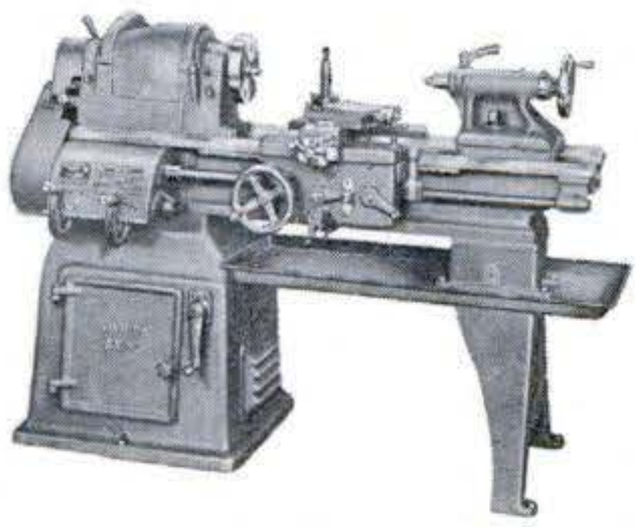
precision bored and burnished to a smoothness of ten microinches (.000010") r.m.s. No other type of bearing can match this for producing accurate work and fine finishes.

IMPROVED CARRIAGE. Fast and easy to operate. New lever operated clutch. Tapered gibs on dovetails of both compound rest top and base. Apron is of rigid one-piece double wall construction with gear shafts supported on both ends. Half-nuts are dovetailed in back wall of apron. Automatic interlock prevents simultaneous engagement of power feeds.

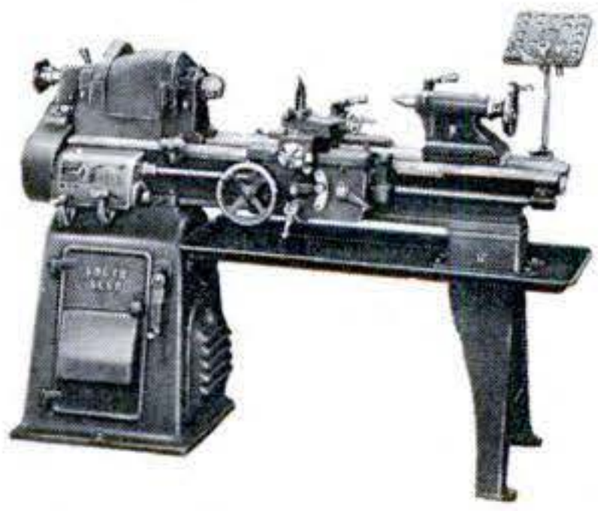
QUICK CHANGE GEAR BOX. Exclusive double tumbler type that simplifies selection of wide choice of threads or feeds. Rugged construction insures trouble-free operation.

RIGID LATHE BED. Heavily made and braced for maximum rigidity to insure accuracy. Headstock, carriage and tailstock aligned by three large V-ways and one flat way. Hardened bed ways for extreme operating conditions optional at small extra cost.

14½" ENGINE LATHE



13" TOOLROOM LATHE



10" ENGINE LATHE

SPECIFICATIONS and PRICES for 10", 13", 14½", 16" and 16-24" LATHES

ENGINE LATHES

LATHE SIZE	Catalog Number	Bed*	Swing Over Bed	Between Centers	Collet Capacity Max.	Spindle Speeds †	Cross Feeds	Longi-tudinal Feeds	Thread Cutting Feeds	Base Price
10"	CL187Y	3'	10⅛"	14"	1-1/16"	12	70	70	70	$1282
13"	CL145A	4'	13⅛"	16"	1-1/16"	8	48	48	48	1675
14½"	CL185B	5'	14⅝"	24"	1-1/16"	8	48	48	48	2074
16"	CL117C	6'	16¼"	33"	1-1/16"	8	48	48	48	2468
16-24"	CL198C	6'	25⅛"	30"	1-1/16"	8	48	48	48	2795

TOOLROOM LATHES

10"	CL8187Y	3'	10⅛"	14"	1-1/16"	12	70	70	70	1698
13"	CL8145B	5'	13⅛"	28"	1-1/16"	8	48	48	48	2246
14½"	CL8185B	5'	14⅝"	24"	1-1/16"	8	48	48	48	2629
16"	CL8117C	6'	16¼"	33"	1-1/16"	8	48	48	48	3077

* Minimum bed length shown, other lengths available. Maximum 14' bed on 16" and 16-24" Lathes.
† Number of speeds shown for 4-step cone pulley (except 10" Lathes), 3-step cone pulley at same price. 2-speed motors available.

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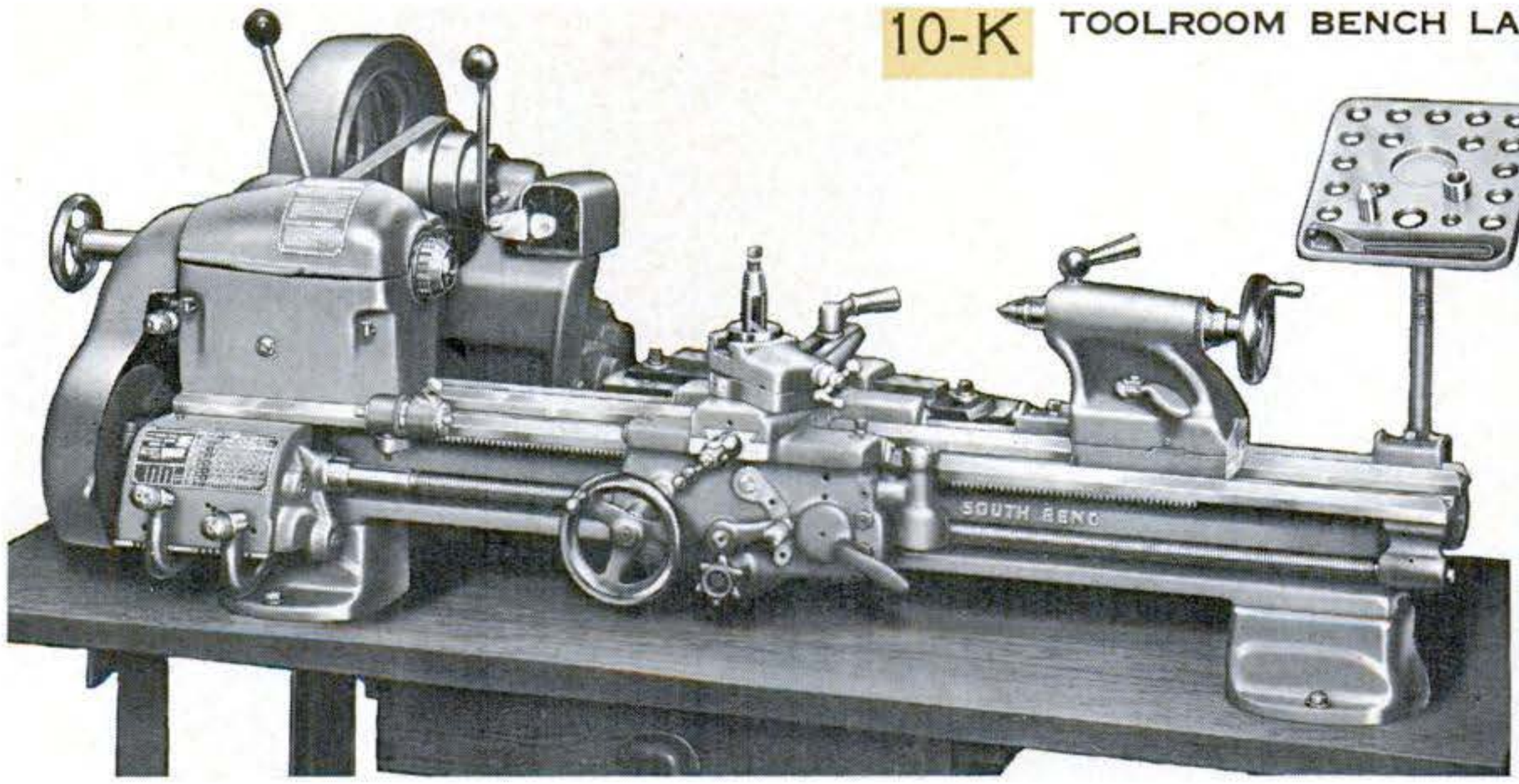
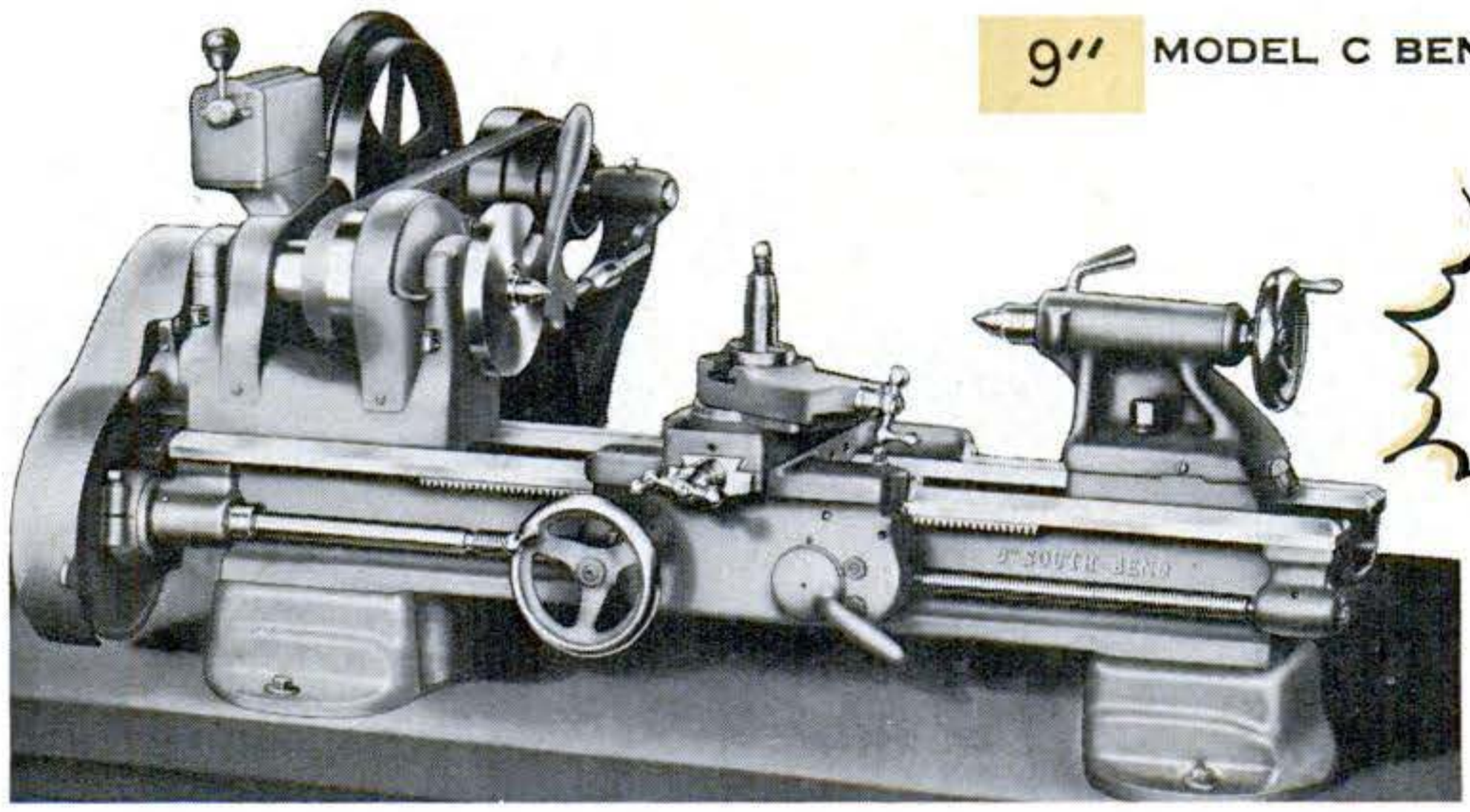
SOUTH BEND

9", 9" Gap Bed, 10-K and 10-K Gap Bed

BENCH LATHES



10-K TOOLROOM BENCH LATHE



9" MODEL C BENCH LATHE

Prices start at **$280**

South Bend 9" and 10-K Bench Lathes are precision machines with many of the features of larger lathes. They are extensively used for machining endless types of small work. Their ability to perform efficiently, regardless of the job, has made them popular every place from experimental to production shops. These lathes are produced in such large quantities that many manufacturing economies have resulted. This makes it possible to offer more accurate and dependable lathes at competitive prices. See facing page for descriptions and prices of various models.

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144 Bench Lathes to choose from

The 9" and 10-K Bench Lathes are available in four models: Model A, Model B, Model C and Toolroom. Each of these are made in various bed lengths and with 6-, 8-, 12- and 16-speed drives.

Model A. Quick change gear box. Universal apron with worm drive for power cross and longitudinal feeds.

Model B. Independent change gears. Universal apron with worm drive for power cross and longitudinal feeds.

Model C. Independent change gears. Plain apron with half-nut drive for power longitudinal feeds. Manual cross feeds.

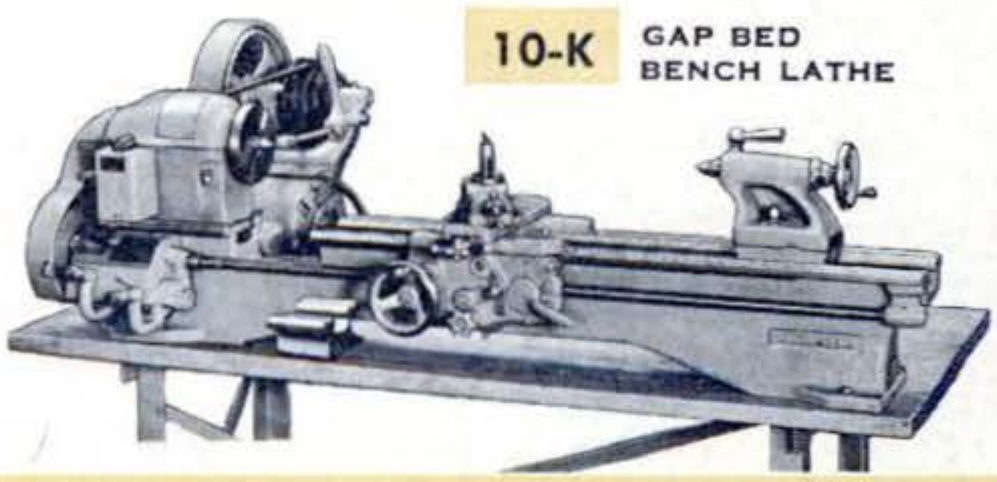
Toolroom. Same as Model A with addition of precision lead screw, handwheel collet attachment, collet rack, plain taper attachment, thread indicator, thread cutting stop, large face plate and micrometer carriage stop.

9" AND 10-K GAP BED BENCH LATHES

These lathes have extra capacity for boring and facing operations. A removable bed insert provides a 5" gap that increases the swing on 9" Lathes to 14⅛" and on 10-K Lathes to 14⅞". With the insert in place, all regular operations can be performed. Made in Models A, B and C; 4½' beds only.

9" AND 10-K FLOOR LATHES

All models of both sizes are made in the Self-Contained Drive type which includes drive equipment, chip pan and floor legs. Also, in Metal Column Base Underneath Motor Drive type (not available in Gap Bed Lathes).



10-K GAP BED BENCH LATHE

SPECIFICATIONS and PRICES for 9", 10-K and 10-K Gap Bed BENCH LATHES

BENCH LATHES

LATHE SIZE	Model	Catalog Number	Bed*	Swing Over Bed	Between Centers	Collet Capacity Max.	Cross Feeds	Longi-tudinal Feeds	Thread Cutting Feeds	Base Price
9"	A	CL644Y	3'	9¼"	16"	½"	48	48	48	$466
9"	B	CL677Y	3'	9¼"	16"	½"	23	26	45	375
9"	C	CL615Y	3'	9¼"	16"	½"	man.	14	45	290
10-K	A	CL670Y	3'	10"	16"	⅝"	48	48	48	546
10-K	B	CL667Y	3'	10"	16"	⅝"	23	26	45	463
10-K	C	CL653Y	3'	10"	16"	⅝"	man.	14	45	388

TOOLROOM BENCH LATHES

9"		CL8644Y	3'	9¼"	16"	½"	48	48	48	691
10-K		CL8670Y	3'	10"	16"	⅝"	48	48	48	776

10-K GAP BED BENCH LATHES

10-K	A	CL670RG	4½'	10"†	34"	⅝"	48	48	48	663
10-K	B	CL667RG	4½'	10"†	34"	⅝"	23	26	45	580
10-K	C	CL653RG	4½'	10"†	34"	⅝"	man.	14	45	505

* Minimum bed lengths shown, other lengths available.
All available with 6, 8, 12 or 16 spindle speeds, only 12-speed drive listed above.
† 14⅞" swing in gap.

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SOUTH BEND

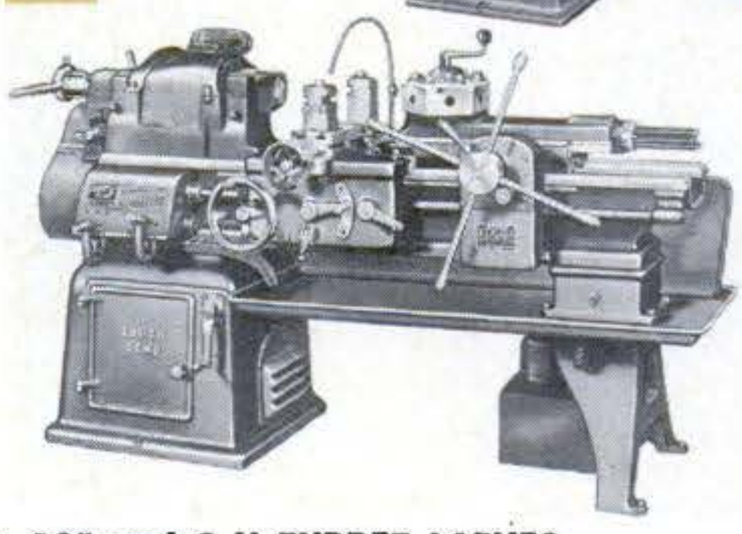
10", 13" and 2-H

TURRET LATHES

10" TURRET LATHE

13" TURRET LATHE

2-H TURRET LATHE



Precision Turret Lathes for Exacting Work

Exceptionally adaptable turret lathes especially suited for small precision parts and critical second operations. They are capable of working to very close tolerances and smooth finishes without sacrificing productivity. Wide ranges of speeds, carriage feeds and turret feeds produce maximum efficiency on any type of job. Turrets will index within ± .0005" at 4" from the turret face.

SPECIFICATIONS and PRICES for 10", 13" and 2-H TURRET LATHES

LATHE SIZE	Catalog Number	Swing Over Bed	Spindle to Turret*	Spindle Speeds	Cross Feeds	Longi-tudinal Feeds	Thread Cutting Feeds	Turret Feeds	Base Price
10"	CL1006Z	10⅛"	19⅜"	12	70	70	70	man.	$1748
13"	CL1BT	13⅛"	23⅝"	6	48	48	48	144	2560
2-H	CL2CT	16¼"	28¼"	6	48	48	48	96	3658

*Maximum for 3½', 5' and 6' beds respectively.

Spindle bore 1⅜", maximum handlever collet capacity 1-1/16" on all sizes.

SOUTH BEND

Pedestal

GRINDERS

Knuckle Room to Spare

Greater work clearance makes grinding easier and faster on this machine. The mounting of the motor within the pedestal eliminates most vibrations, takes wheel load off motor bearings and protects motor from abrasive dust. 8" or 10" wheels. **Pedestal Grinder** (8") No. CE2725, less motor **$282**

TIME PAYMENT PLAN

3¼% interest on original unpaid balance per year—up to 36 months to pay.

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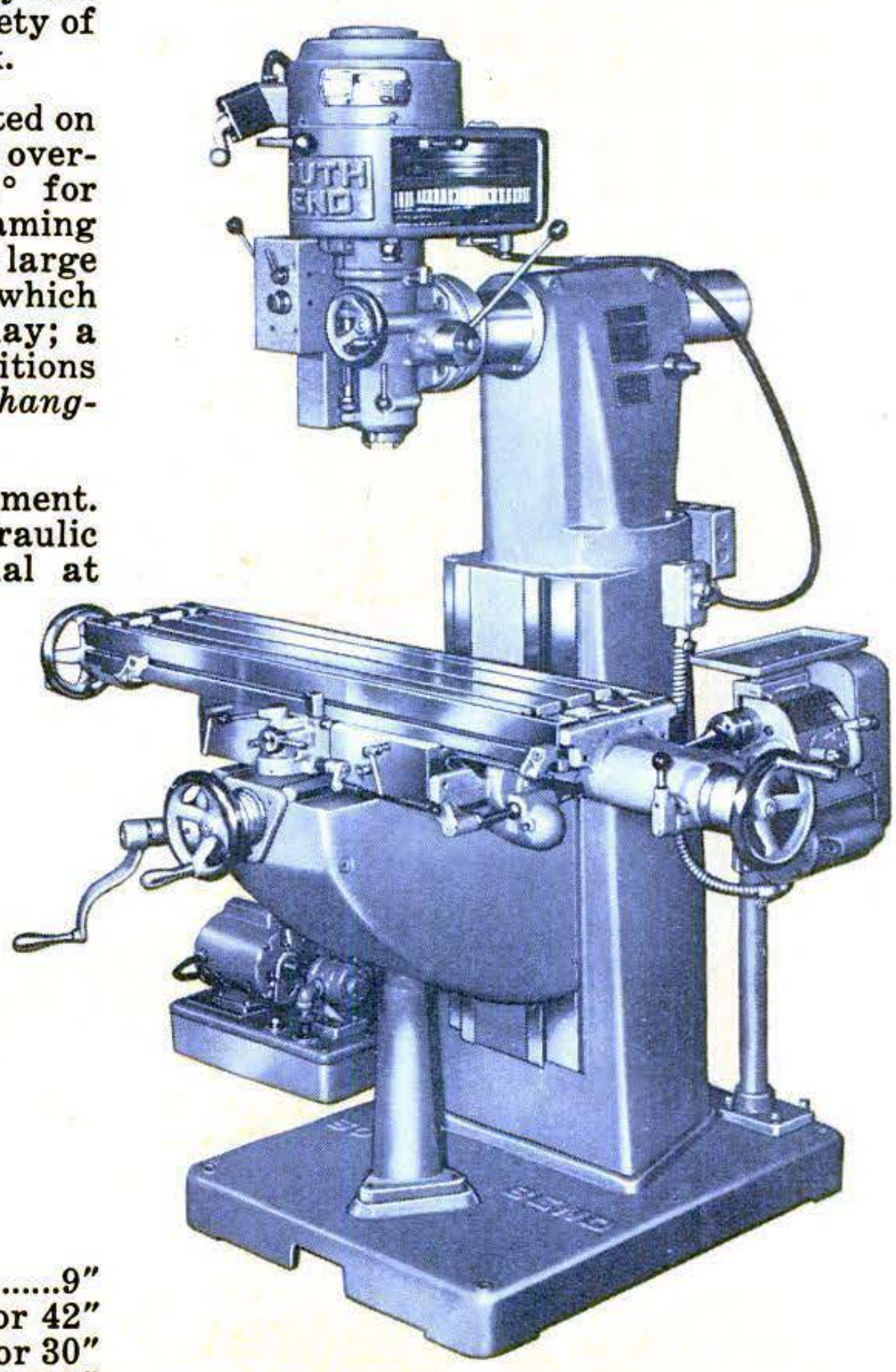
More Milling for Less Cost

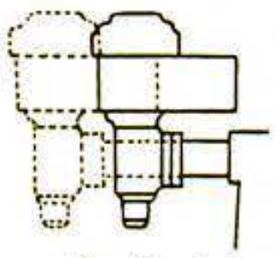
The South Bend Vertical Spindle Milling Machine brings efficiency and ease of operation to a wide variety of toolroom and production work.

Its universal type head is mounted on a large flange on the end of the overarm and swivels through 360° for milling, drilling, boring and reaming at any angle. The overarm has a large key with adjustable tapered gib which eliminates any possibility of play; a rack and pinion adjustment positions the head horizontally *without changing its angular alignment.*

Spindle brake is standard equipment. Power Table Feed and Hydraulic Power Quill Feed are optional at extra cost.

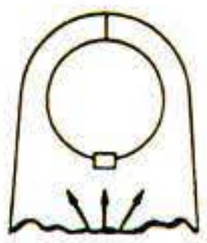


Only South Bend Offers These 3 Overarm Features



Horizontal head travel without angular resetting.

Head rotates 360°, overarm does not turn.



Adjustable tapered gib in keyway prevents play. More bearing surface.

SPECIFICATIONS

Table width	9"
Table lengths	32" or 42"
Table travel, longitudinal	20" or 30"
Table travel, cross	9½"
Table travel, vertical	18"
Table to spindle, max.	20"
Spindle to column, max.	20"
Ram travel	15"
Head rotates	360°
Quill diameter	3¼"
Quill travel	4"
Collet capacity, max.	¾"
Spindle speeds	8

PRICES

Catalog Number	Table Length	Motor R.P.M.	Motor H.P.	Price
MIL3212	32"	1200	¾	$1829
MIL3218	32"	1800	1	1829
MIL4212	42"	1200	¾	1911
MIL4218	42"	1800	1	1911

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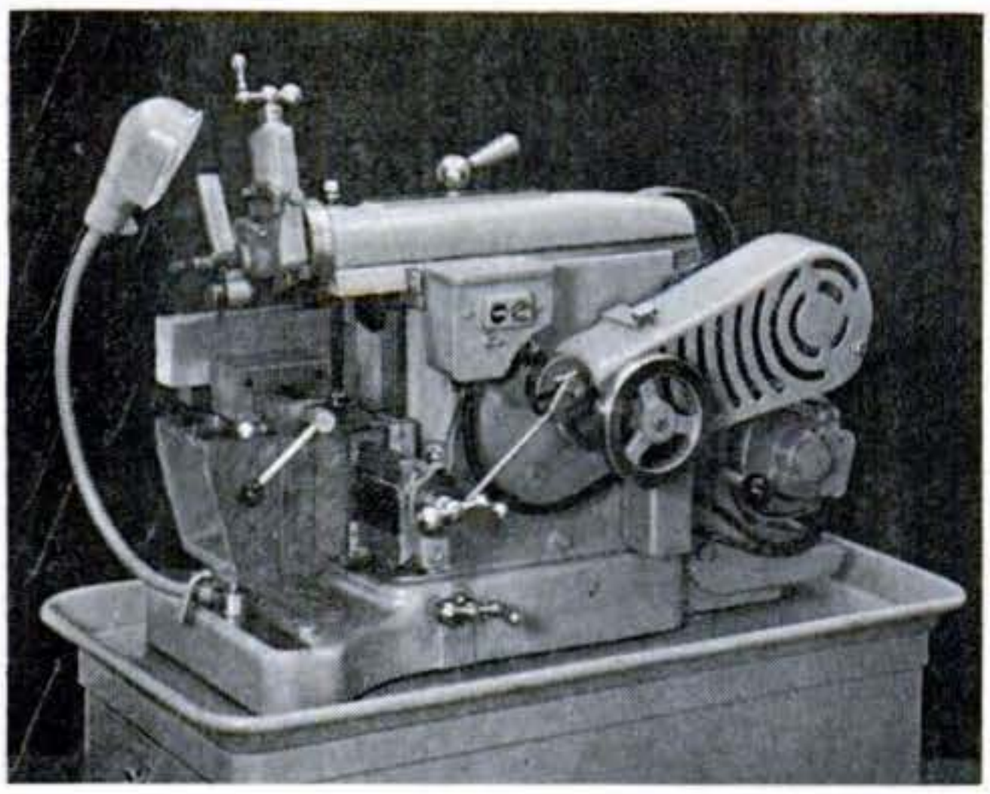
SOUTH BEND

7"

BENCH SHAPER

An accurate, compact bench shaper that meets the need for fast, precision work in toolroom, production, experimental, and maintenance shops. It is ruggedly designed and carefully constructed to give long, dependable service with a minimum of maintenance.

The only bench shaper with pressure lubrication!



SPECIFICATIONS and PRICE

Length of ram stroke .....0 to 7"
Strokes per minute, approx. 42-75-120-195
Cutting speeds .....3 to 114 fpm.
Tool head swivels .....360°
Horizontal table travel .....9½"
Vertical table travel .....5"
Table to ram .....½" to 5½"
Power cross feeds ..... .002" to .012"

PRICE. Cat. No. CS100 less motor, tool holder and steel stand, f.o.b. factory **$602**

TELESCOPIC TAPER ATTACHMENT

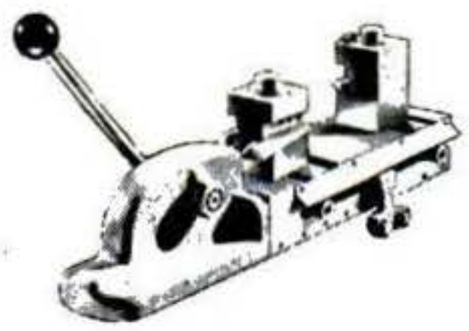
MILLING ATTACHMENT

MICROMETER CARRIAGE STOP

TELESCOPING JAW FOLLOWER REST

10-IN-1 TOOL HOLDER

PIPE CENTERS



HANDLEVER DOUBLE TOOL CROSS SLIDE

UNIVERSAL TABLE CE9156.....$106

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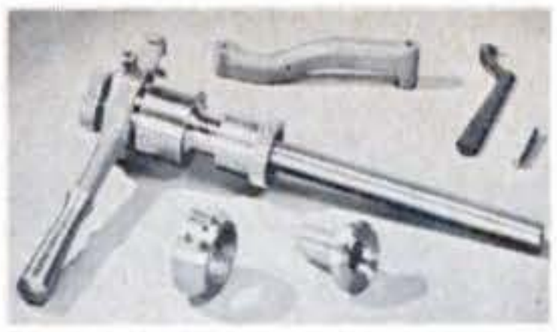
SOUTH BEND

Tools and

ATTACHMENTS



HANDLEVER COLLET ATTACHMENT

RED ARROW COLLETS

BALL BEARING LIVE CENTERS

SQUARE TURRET TOOL BLOCK

Get More Work out of Your Machines with these Attachments

Cut Machining Time • Simplify Difficult Jobs • Speed Up Tooling • Handle More Types of Jobs

EXTERNAL GRINDING ATTACHMENT

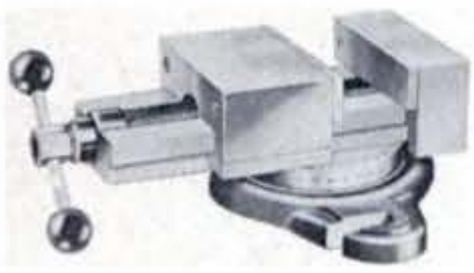
TELESCOPING JAW STEADY REST

HANDWHEEL COLLET ATTACHMENT

FOUR-POSITION CARRIAGE STOP

HANDLEVER BED TURRET

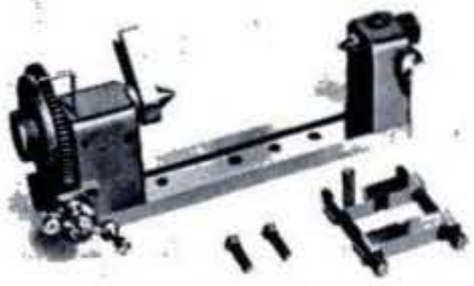
HANDLEVER TAILSTOCK TURRET



SWIVEL MACHINE VISE
CE9100.....$28.35

ROTARY INDEXING TABLE
CE9144.....$58.50

CUTTER BIT GRINDING BLOCK
CE2168.....$7.50



INDEXING CENTERS
CE9635.....$73.25

Prices on Next Page

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PRICES OF LATHE ATTACHMENTS

Partial list—write for complete catalog

(Catalog numbers appear below prices)	9" LATHES	10K LATHES	10" LATHES	13" LATHES	14½" LATHES	16" LATHES
Ball Bearing Live Center, 60° point	$18.20 CE3900	$18.20 CE3900	$18.20 CE3900	$21.55 CE3901	$21.55 CE3901	$21.55 CE3901
Ball Bearing Live Center, 60° hollow point	$18.20 CE3903	$18.20 CE3903	$18.20 CE3903	$21.55 CE3904	$21.55 CE3904	$21.55 CE3904
Pipe Center, ½" to 3" pipe, (less shank), others to 8" cap.	$6.30 CE2160	$6.30 CE2160	$6.30 CE2160	$6.30 CE2160	$6.30 CE2160	$6.30 CE2160
Shank for CE2160	$5.40 CE2172	$5.40 CE2172	$5.40 CE2172	$6.25 CE2174	$6.25 CE2174	$6.25 CE2174
Four-Position Carriage Stop	$25. CL2185NK	$25. CL2185NK	$26. CL2185R	$27. CL2185T	$30. CL2185FH	$30. CL2185FH
Micrometer Carriage Stop	$22.95 CL968NK	$22.95 CL968NK	$23.95 CL968R	$27. CL968T	$28. CL968FH	$28. CL968FH
10-in-1 Tool Holder	$14.70 CE1413NK	$14.70 CE1413NK	$15.85 CE1413R	$18.85 CE1413T	$21.85 CE1413F	$22.70 CE1413H
Square Turret Tool Block	$44.75 CL3375N	$49.50 CL3375K	$53. CL3375R	$59. CL3375T	$85. CL3375F	$92. CL3375H
Telescoping Jaw Follower Rest	$10.10 CL2395N	$11.45 CL2395K	$12.55 CL2395R	$14.20 CL2395T	$17. CL2395F	$18.60 CL2395H*
Telescoping Jaw Steady Rest	$15.85 CL2400N	$17.25 CL2400K	$19.75 CL2400R	$24. CL2400T	$28. CL2400F	$31.15 CL2400H*
Taper Attachment	$93. CL428NK	$93. CL428NK	$194. CL1545R	$233. CL1545T	$251. CL1545F	$281. CL1545H
Milling Attachment	$53.50 CL2680NK	$53.50 CL2680NK	$66.50 CL2680R	$82.50 CL2680T	$96.50 CL2680F	$112. CL2680H
External Grinding Attachment with bolt	$72.20 CE301B	$72.20 CE301B	$72.75 CE301B	$73.25 CE301B	$73.85 CE301B	$73.85 CE301B
11-pc. Tool and Chuck Assortment	$78. CL2890NK	$78. CL2890NK	$125. CL2890R	$156. CL2890Q	$182. CL2890M	$208. CL2890H
Handlever Double Tool Cross Slide	$98.50 CL2030N	$104.50 CL2030K	$115. CL2030R	—	—	—
Handlever Bed Turret	$284. CL1611N	$291. CL1611K	$298. CL1611R	$320. CL1611T	—	—
Handlever Tailstock Turret	$126.50 CL2045N	$134.50 CL2045K	$146.50 CL2045R	$175.50 CL2045T	—	—
Handlever Collet Attachment	$85.50 CL5206N	$101. CL5206K	$135. CL5206L	$150. CL5206Q	$164. CL5206M	$178. CL5206H
Handwheel Collet Attachment	$21.50 CL4306N	$24.50 CL4306K	$60. CL4306L	$65.50 CL4306Q	$70. CL4306M	$73. CL4306H
Red Arrow Collets Std. round—by 64ths	$4.80 CE3050	$4.95 CE3051	$5.95 CE3054	$5.95 CE3054	$5.95 CE3054	$5.95 CE3054

* Attachments for 16" Lathes can be used on 16-24" Lathes except for those indicated (*). Many of these attachments can be used on South Bend Turret Lathes and also other makes of lathes. Catalog numbers appear below all prices—they must appear on all orders.

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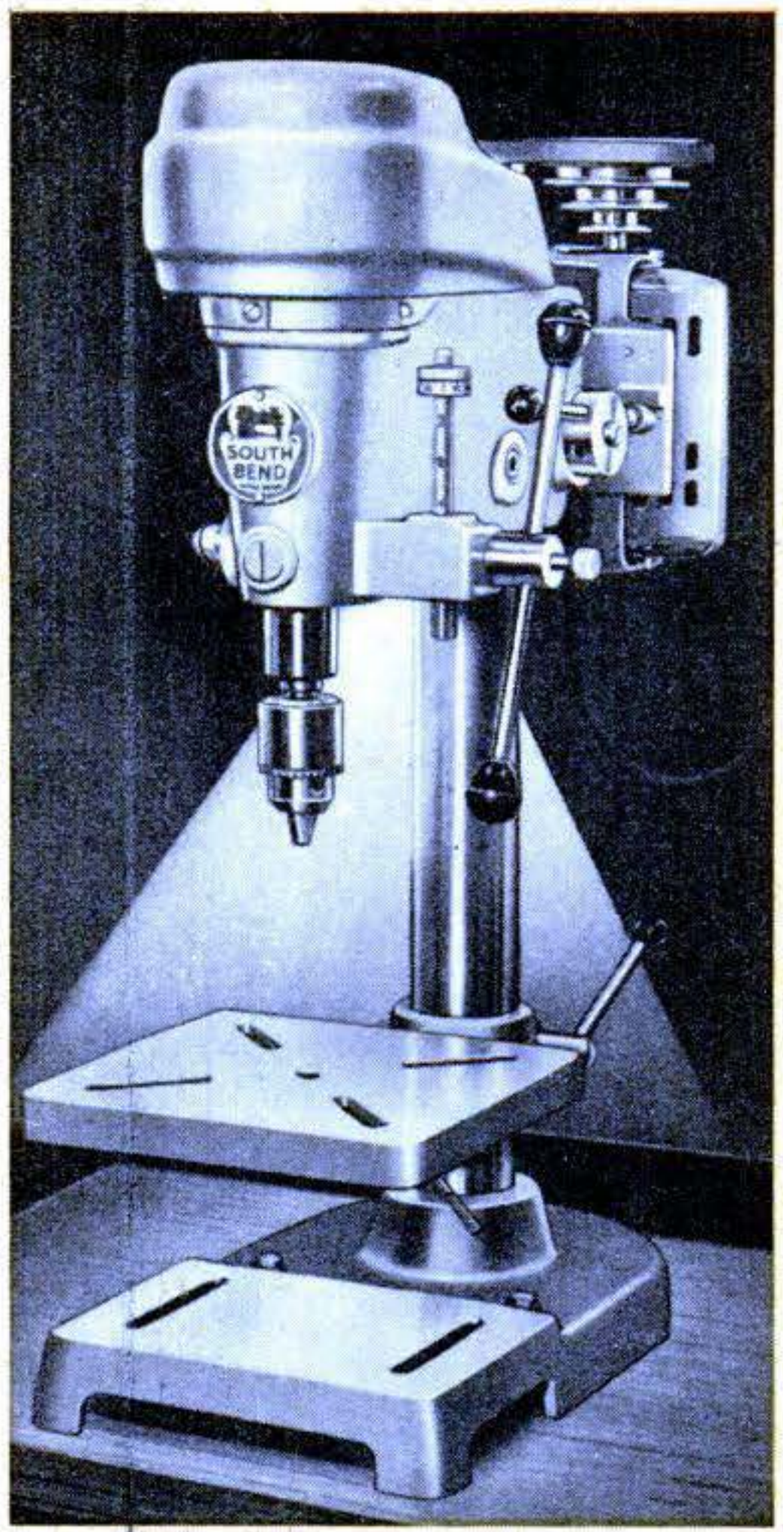

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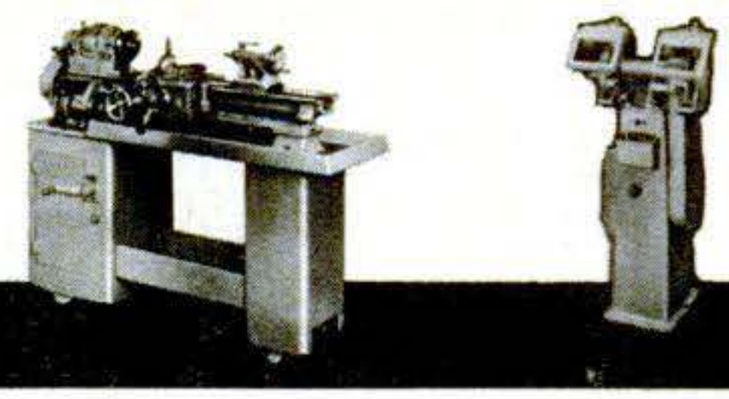

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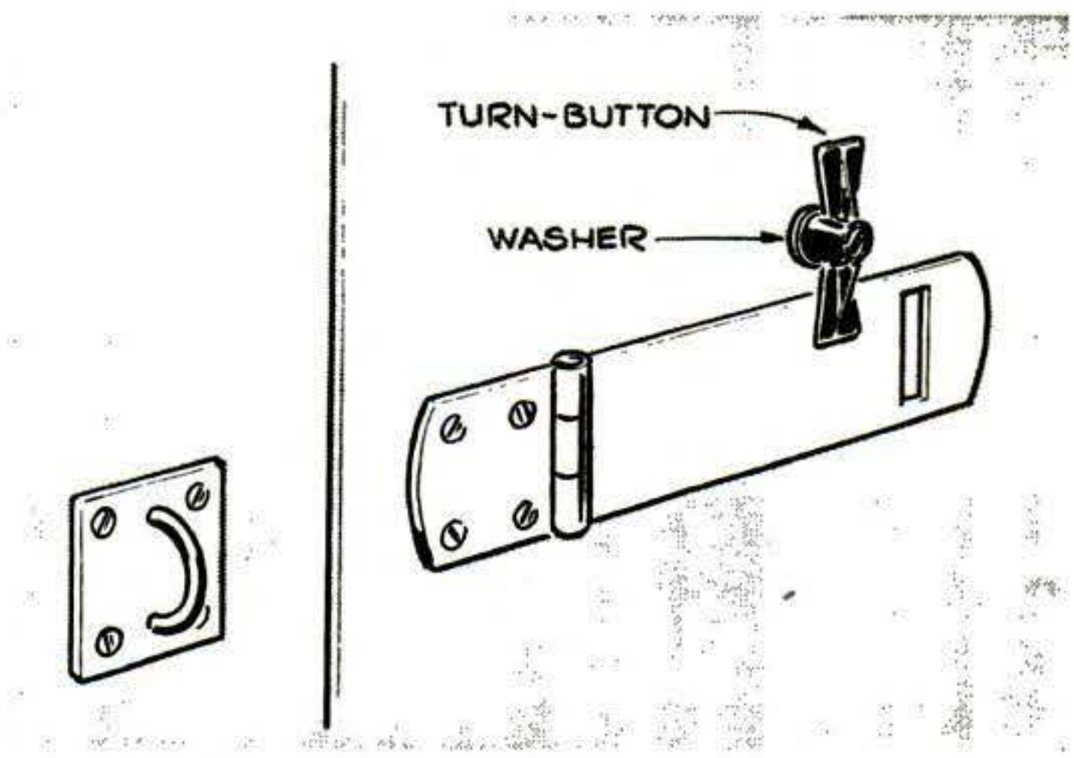
Short Cuts and Tips

FROM PS READERS

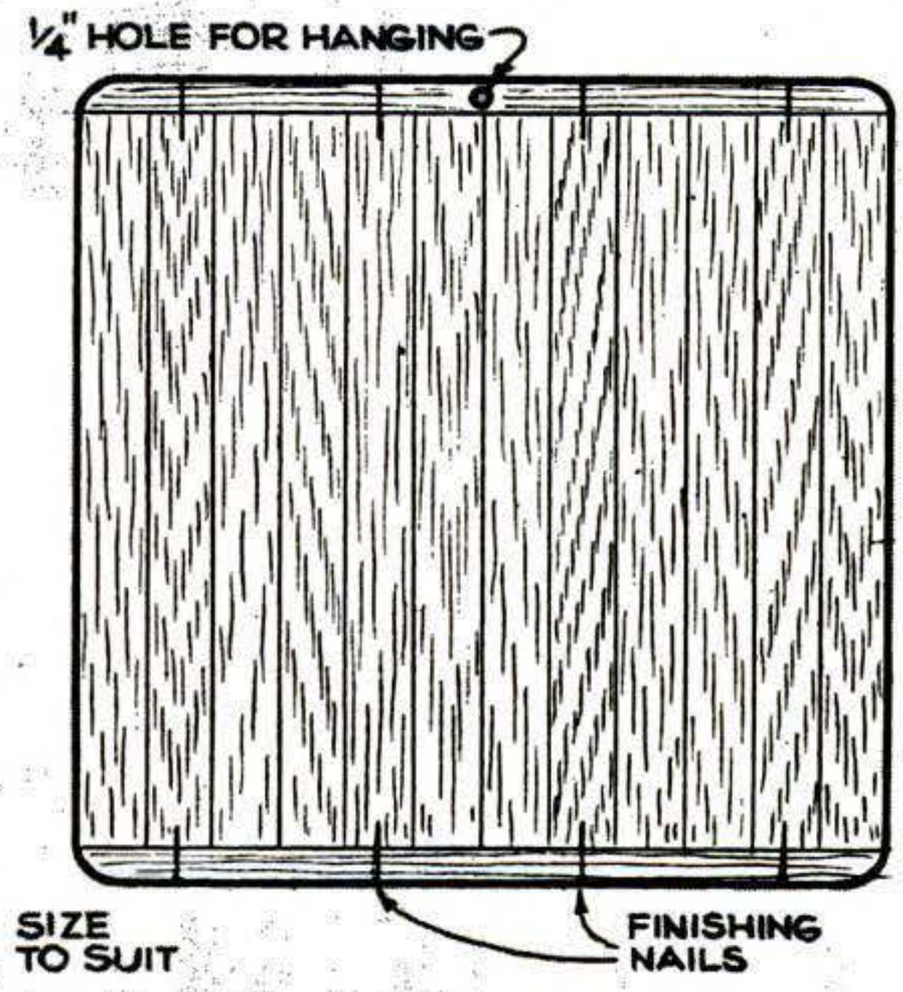
Darkroom Carrying Rack

FOR the part-time darkroom, such as kitchen or bath, keep your solutions together in a milk-bottle rack. If your dairy can't supply one, try a department store. —*W. H. McClay, Pasadena, Cal.*



Securing an Open Hasp

TO KEEP a hasp from swinging out to jab you or catch in your clothing every time you open the door, pin the leaf back with a turn-button installed with a washer. —*Victor H. Lamoy, Upper Jay, N. Y.*



Breadboard from Flooring

OAK or maple flooring makes a good cutting board for the kitchen. Your dimensions determine what size bundle to buy. My board measures 15″ by 22″.

Cut pieces to identical lengths and trim two outside edges square. Apply glue to tongues and grooves and assemble with bar clamps. Rip two narrow end cleats and attach with glue and nails. Remove excess glue, sand, and apply salad oil.—*E. B. Johnson, Stambaugh, Mich.*

Removing Stubborn Glue

WHEN sandpaper misses bits of glue in pits and scratches on a surface you're refinishing, try a plain rubber eraser. It can't mar the wood, and it works particularly well on old contact cement.—*H. L. Wilkins, Washington Court House, Ohio.*

▶▶▶REPLACEMENT tires for tricycles are sometimes hard to find. Try stringing a door spring through a length of rubber hose.—*Mrs. L. L. Schultz, Berwyn, Ill.*

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You can see over and around, and close up, too, by making—

A Periscope That Magnifies the Scene

By Charles D. Neal

WHEN was the last time you yearned to be a foot taller? At that parade you didn't see because of heads bobbing in front of you?

Here's a periscope that will let you peer over heads and around corners. As a bonus, it magnifies the scene 3.8 times. It's ideal for studying wildlife or identifying aircraft, and the kids will enjoy using it from a secret hide-out.

A 14″-by-18″ piece of ¼″ veneer plywood will supply all the casing parts except for the eye-lens mount; that's made from a scrap of birch or maple.

The optical equipment consists of two front-surface mirrors you can pick up for less than a dollar, and two lenses that will cost under $2.50. The top mirror is 43 mm. by 46 mm., and the bottom one is 37 mm. square. The double-concave front lens has a 19-mm. diameter and a minus-50-mm. focal length. The achromatic objective lens behind it is 52 mm. in diameter, with a 192-mm. focal length.

Cut out the L-shaped side members from the plywood first. The other parts are simple rectangles, except for the mirror-mounting strips which are notched or beveled as shown. The eyepiece is made by boring the center from a 1″-by-1″-by-1⅜″ block of hardwood, using two Forstner bits. A 13/16″-diameter hole is bored to a depth of 1 3/16″; for the remaining 3/16″ use a ½″ bit. The eyepiece shown was contoured on the lathe, but this was for appearance, not efficiency. The eye lens is inserted from the back and secured with a mounting ring of ⅛″ cardboard.

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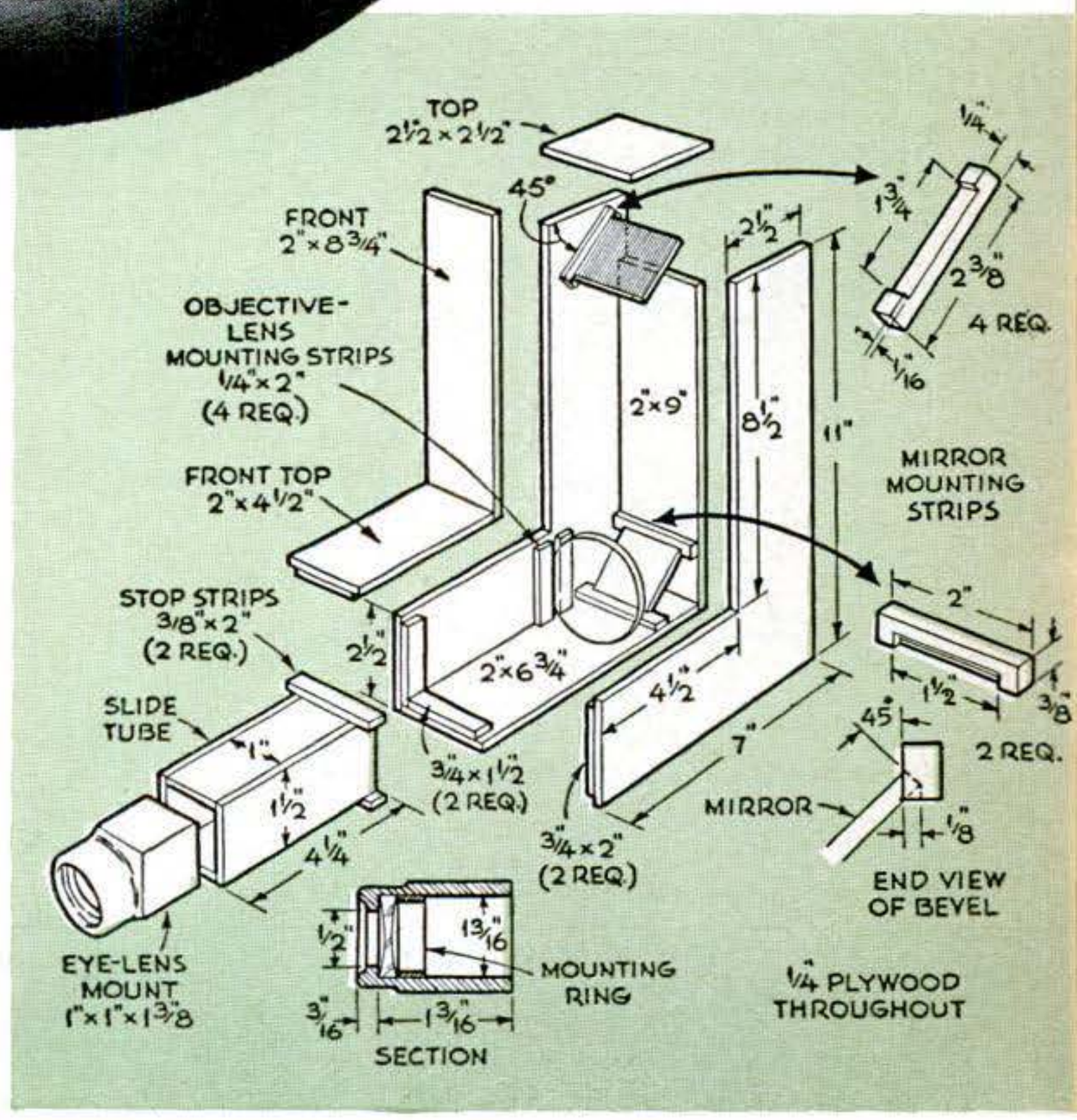

Using ⅝″ wire nails, attach the two L-shaped side pieces to the back and the bottom, and join the front and front top piece as shown. Assemble the four members of the slide tube. Now carefully locate the mirrors and the objective lens, making certain the mirrors are mounted at a 45-degree angle, facing and exactly parallel to one another.

Tack the mounting strips in place temporarily with ⅜″ brads. Also fasten the four slide-tube guide strips in place, locating three of them flush with the front edge of the L-shaped tube and the fourth on the underside of the front top. Attach the two stop strips at the back of the slide tube and insert the eyepiece at the front. Drop the slide tube into its channel.

To check the optical mechanism, put the front assembly temporarily in place. Look through the eyepiece, moving the slide tube in and out until a distant object is in sharp focus. If difficulties are encountered, recheck the positions of the mirrors and lenses. The top mirror must reflect the image down the vertical tube to the lower mirror, which diverts it horizontally through the magnifying lens. When adjustments are complete, remove mirrors and lenses, secure the mounting strips, and apply a coat of flat black paint to all wood surfaces. When the paint is dry, replace optical parts permanently and complete the assembly.

LIST OF OPTICAL PARTS
(one each)

43 mm. x 46 mm. front-surface mirror
37 mm. x 37 mm. front-surface mirror
19-mm. double-concave lens of minus-50-mm. focal length
52-mm. achromatic objective lens of 192-mm. focal length

All parts available from the Edmund Scientific Co., Barrington, N. J.

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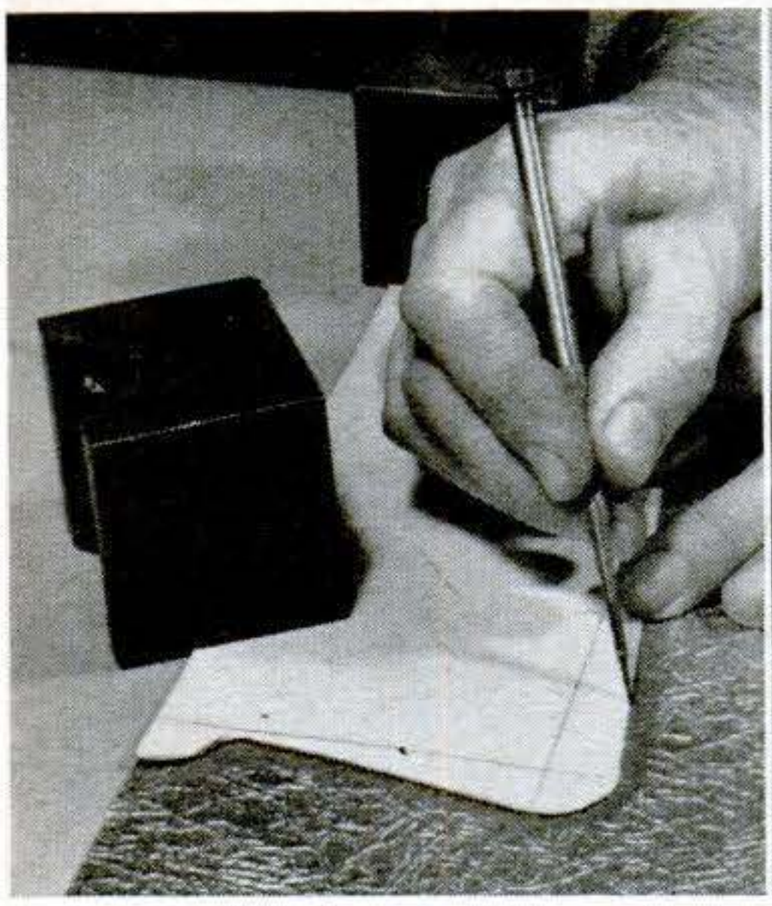
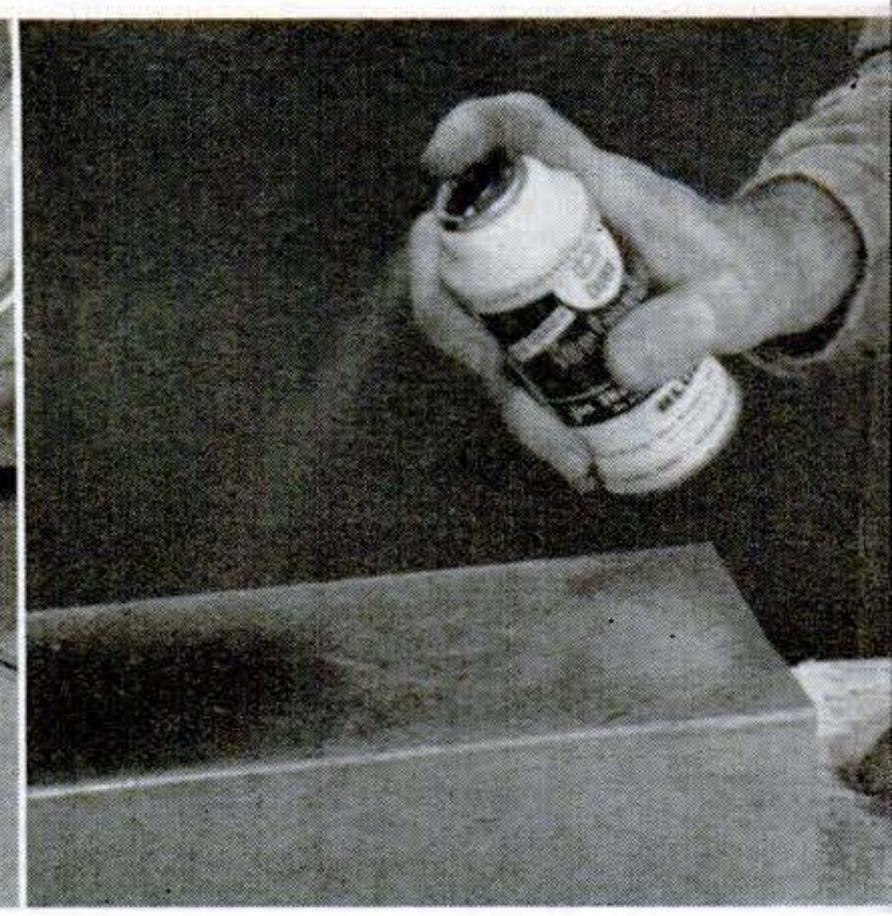
Use dark coatings for bright-surface metals



MODEL-AIRPLANE DOPE is fine for scriber work. Ordinary lacquers tend to tear, producing ragged lines. If metal is to be painted, use some first as a marking base. It will usually take pencil lines readily.

MARKER INKS for labeling provide good base for scribing and come with built-in brush. Dab color on thin but evenly. For quick marking of small areas, rub on grease pencil and scribe it with a sharp lead pencil.



TOOLMAKER'S INKS, made especially for layout work, now come in spray cans. Usually blue, they dry quickly and have a good masking effect. You can remove most coatings from the metal with lacquer thinner.

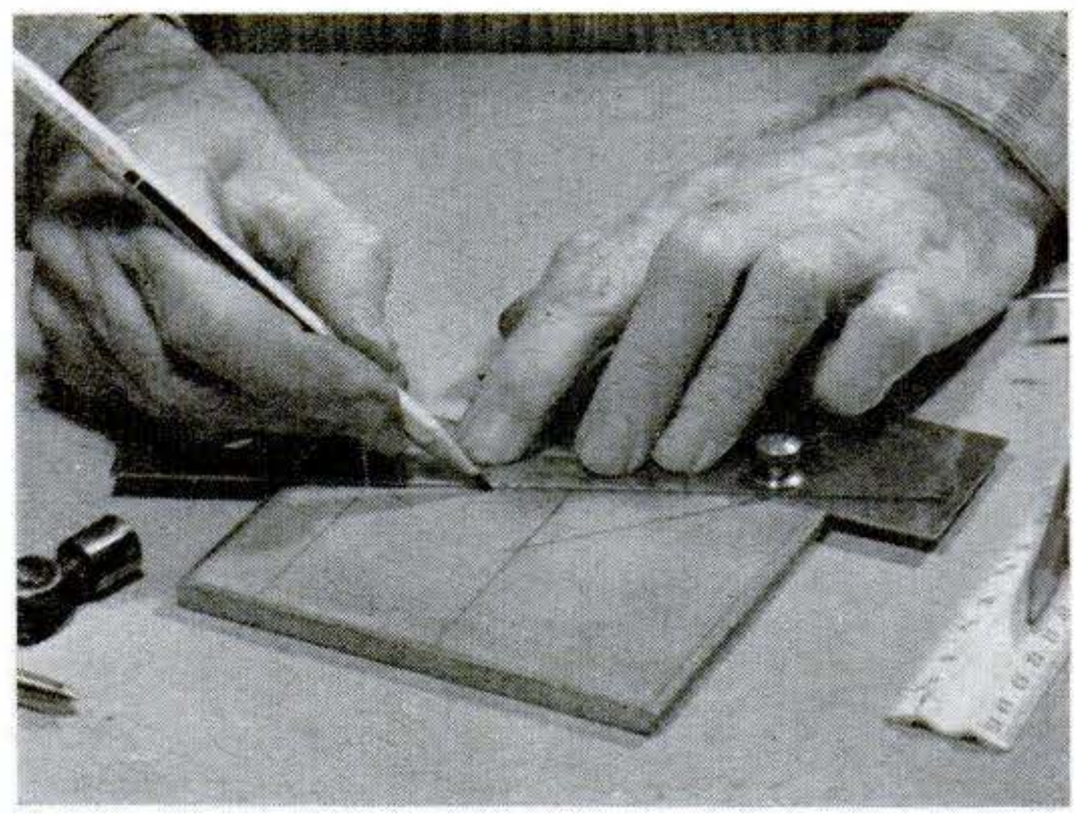
Marking Metal for Layouts

By Walter E. Burton

EVER try to make a mark on shiny metal? Indicating precisely where a hole is to be drilled or a cut made is often a problem. Most metals don't take a pencil mark, which often wouldn't be accurate enough anyway. Other metals either defy the sharp point of a scriber, or shouldn't be permanently marked.

Plating a surface

OLD-TIME METHOD of making metal markable is to swab it with a solution of copper sulfate, which plates the surface. Since color is fairly permanent and messy to apply, method is giving way to more convenient modern markers.



Dulling a surface

SHINY METAL that will be finished dull or later painted can be made to take pencil lines by removing the sheen. A paste of fine silicon carbide rubbed on with a steel block is best for this, but fine abrasive paper can also be used.

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TO BRING OUT FAINT LINES that have already been scribed on metal, printer's ink has a special virtue. Applied with a rubber roller, it will make the lines magically reappear. Don't use it, however, for general marking, as it dries slowly, is not as easy to clean off as other markers.

The solution? Take a tip from the pros and prepare your metal first with inks and colorings that make markings stand out clearly. These provide a coating on which a scriber can etch accurate lines.

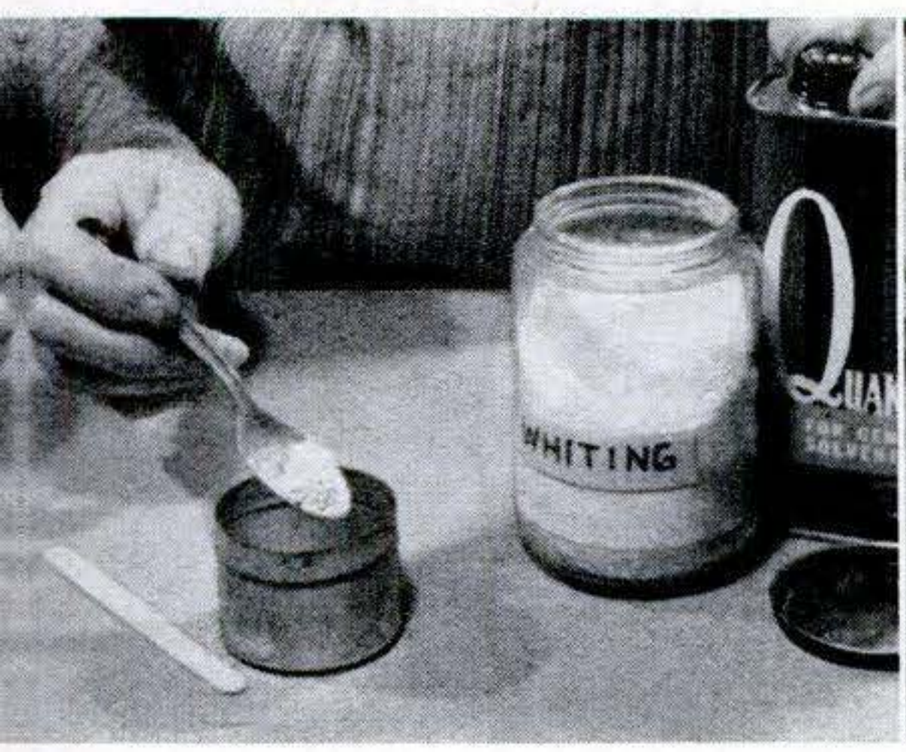
Some markers are special preparations; some can be as common as shoe polish. Dark colors are naturally used for light metals and light colors for dark ones. Here's a run-down on some tricks.

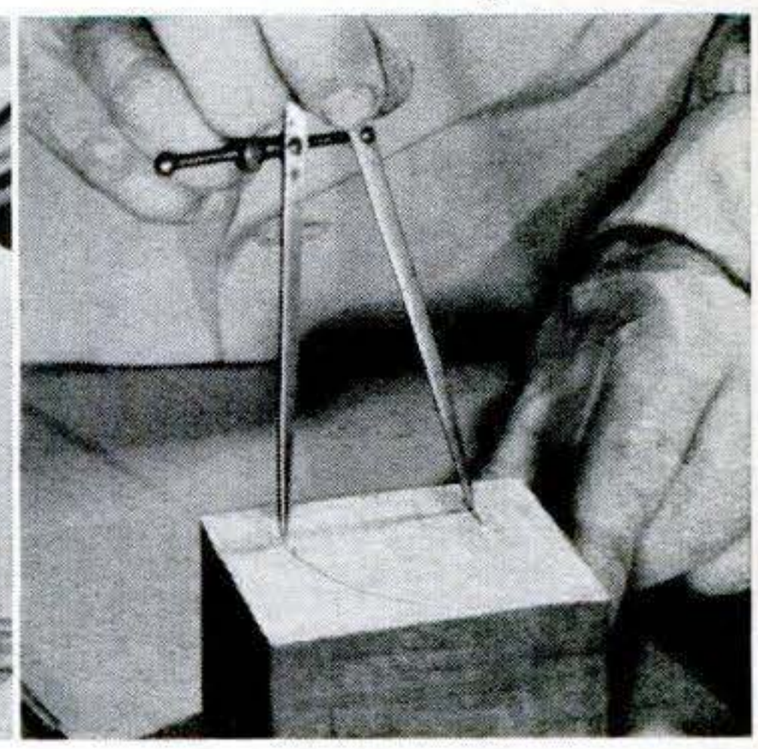
Use light-colored coatings on dark-surface metals

NON-BRIGHT SURFACES, such as cast iron and age-darkened steel need light colors for contrast. Apply whiting (powdered chalk) mixed with alcohol. Or rub on blackboard chalk and blow off the excess.

WHITE SHOE POLISH is one of easiest materials to apply and can be used in place of chalk or whiting. Chinese white and tempera water-mixed paints, all easy to obtain, can be swabbed on in the same way.

TEST SURFACE with a compass or scriber. If coating is not even or dense enough, you may need a second application. For pencil marking, use a sharp point but soft lead. Water removes most of the white coatings.





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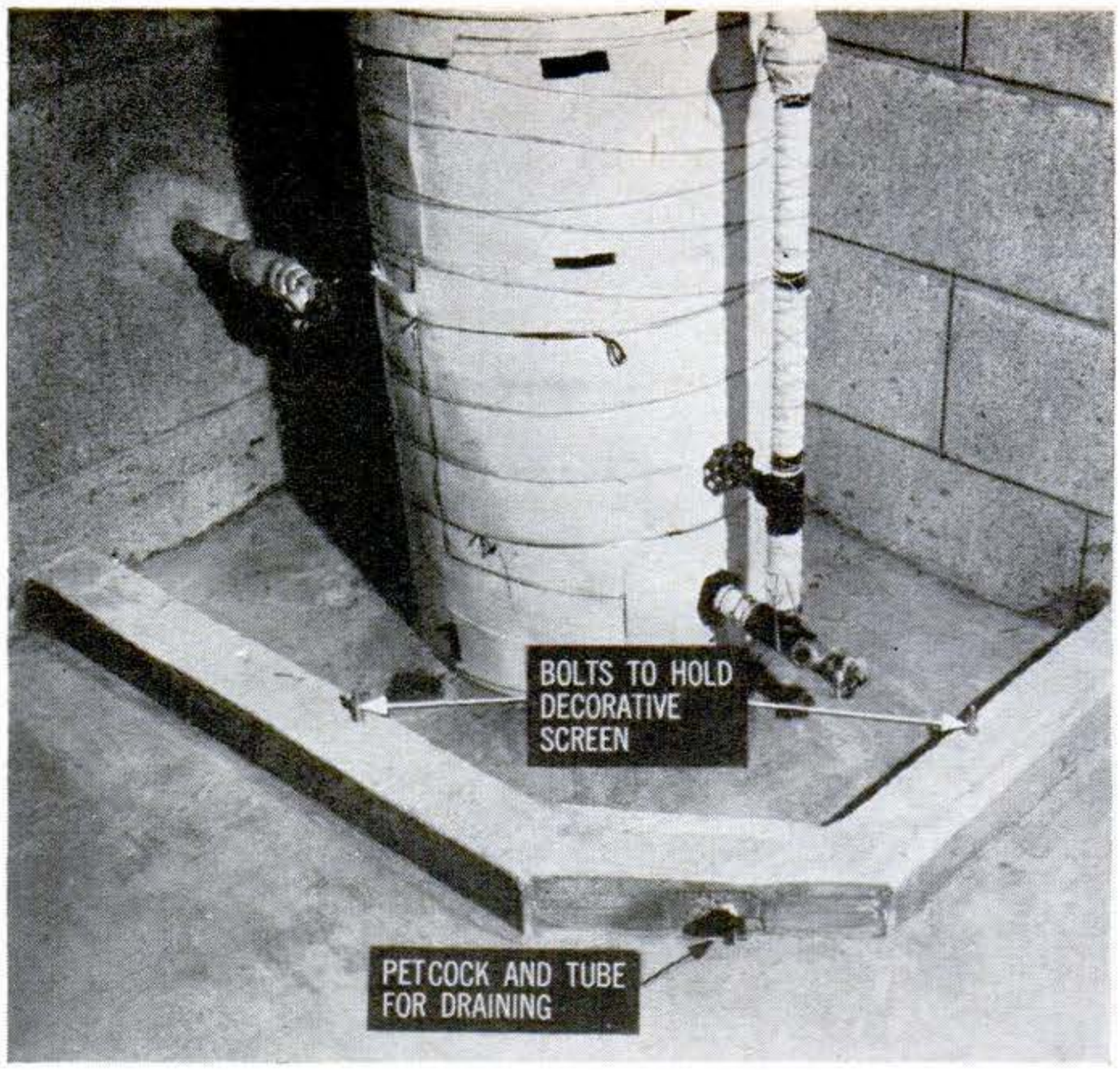
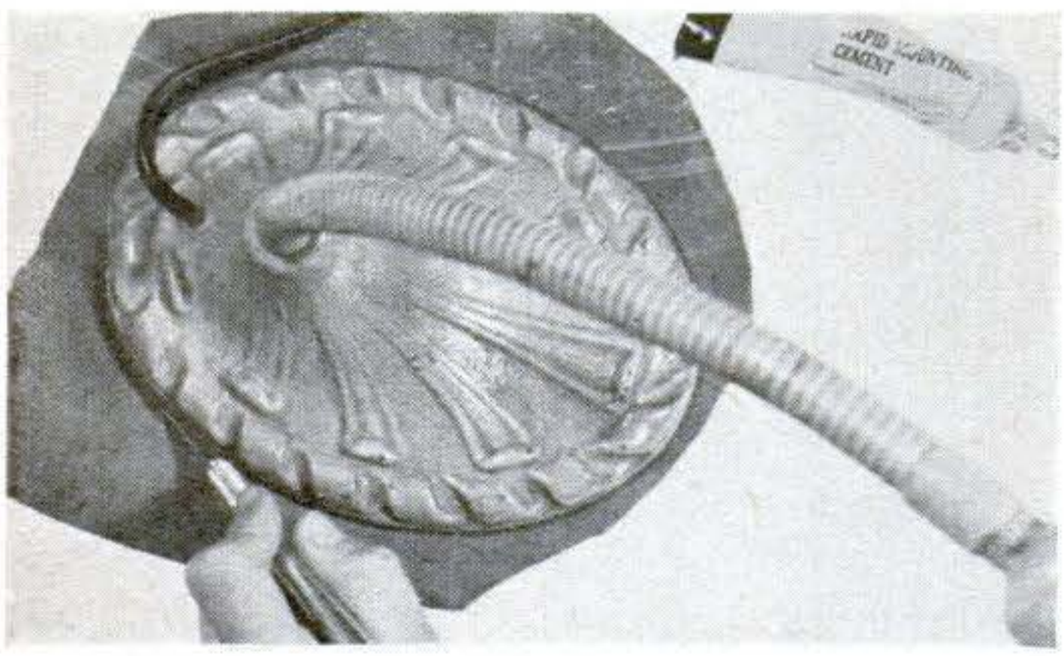
Short Cuts and Tips

FROM PS READERS

Dam to Keep Basement Dry

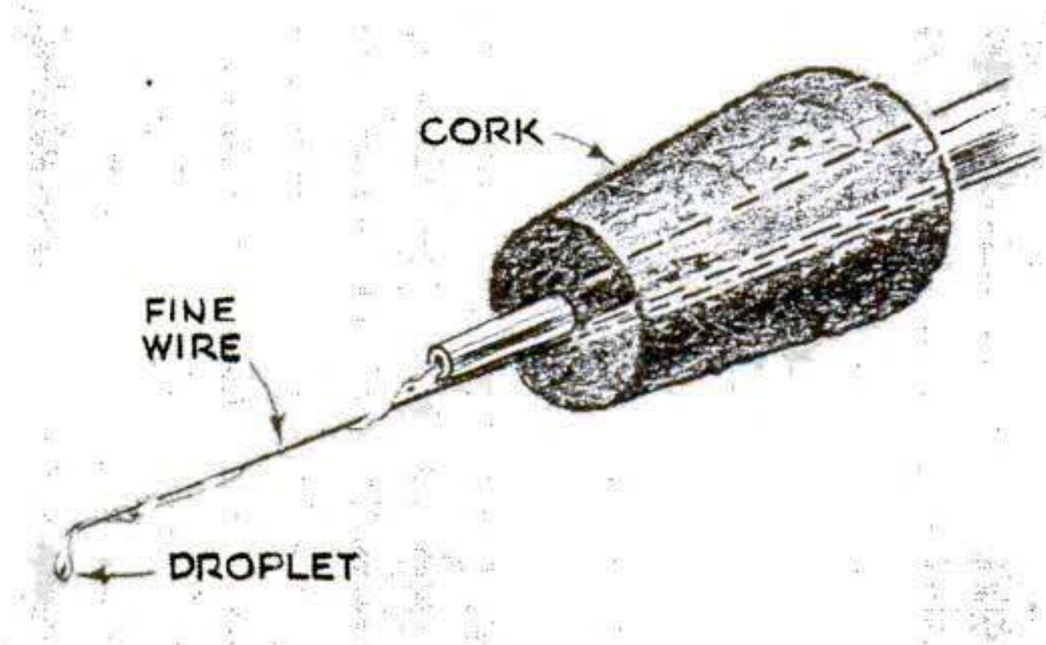
My well-water tank, even when wrapped, continued dripping. I couldn't tile my basement floor until I solved the problem. A concrete wall, 3″ high and 3½″ wide, now blocks off the corner. Bolts embedded in the dam hold a decorative screen. A brass radiator petcock soldered to a ½″ copper pipe running through the wall handles drainage. —*C. Leino, New Berlin, Wis.*





Restoring Scratch Protection

When the rubber feet or felt pads on articles like desk lamps, book ends, clocks or radios have worn away, this protection for finished surfaces can be restored by cementing a piece of inner tube or rubber rug cushion to the base. Allow cement to set and trim around the edge with a sharp knife.—*H. M. Hughes, Inglewood, Cal.*

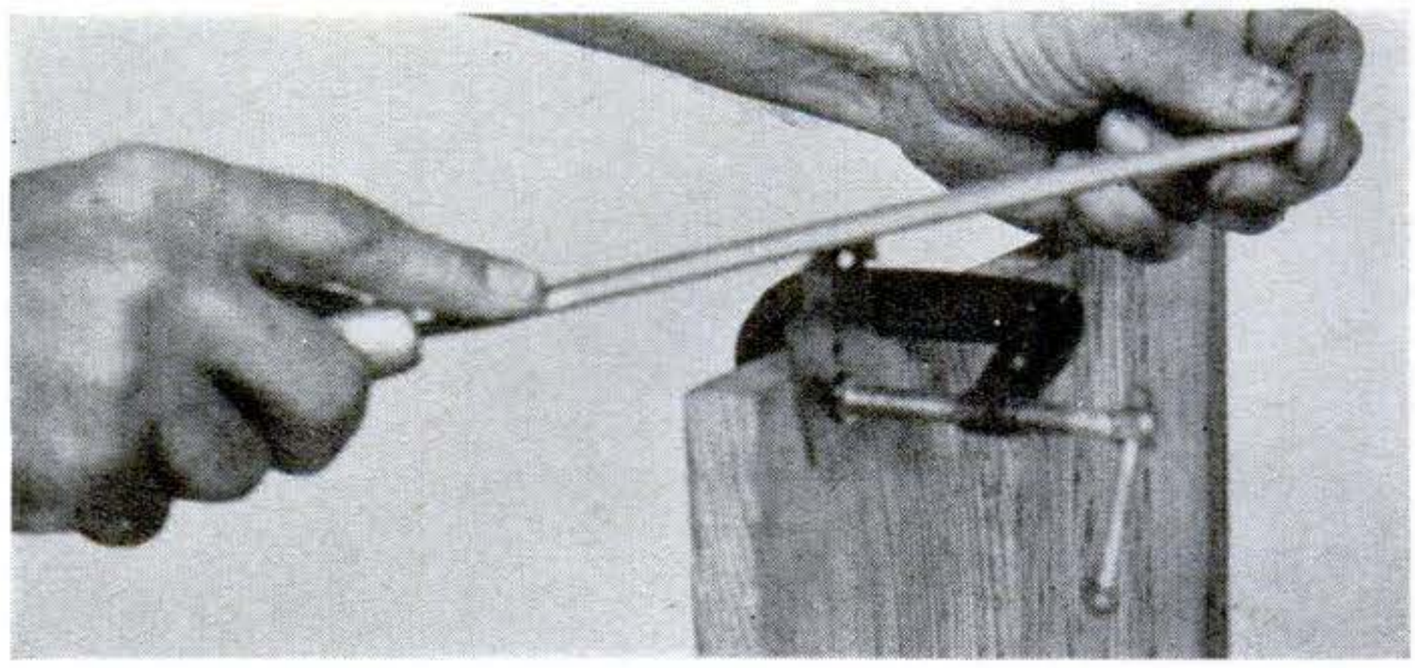


Oil for Hard-to-Reach Spots

If oiling is a tight squeeze, try this trick. Force a bottle cork down over the oil-can spout so that the spout protrudes slightly. Then stick a needle or a piece of stiff, small-gauge wire into the cork, just below the spout. You'll find that oil drops will flow neatly down the wire.—*Albert Wallin, Baraga State Park, Mich.*

C Clamp with a Vise Grip

A C clamp and a steady support can be a handy substitute for a vise. Portable and easy to use, the clamp will hold your work rigidly for filing or fabricating. A small one can be carried in your pocket.—*Michael Ligocki, Gary, Ind.*



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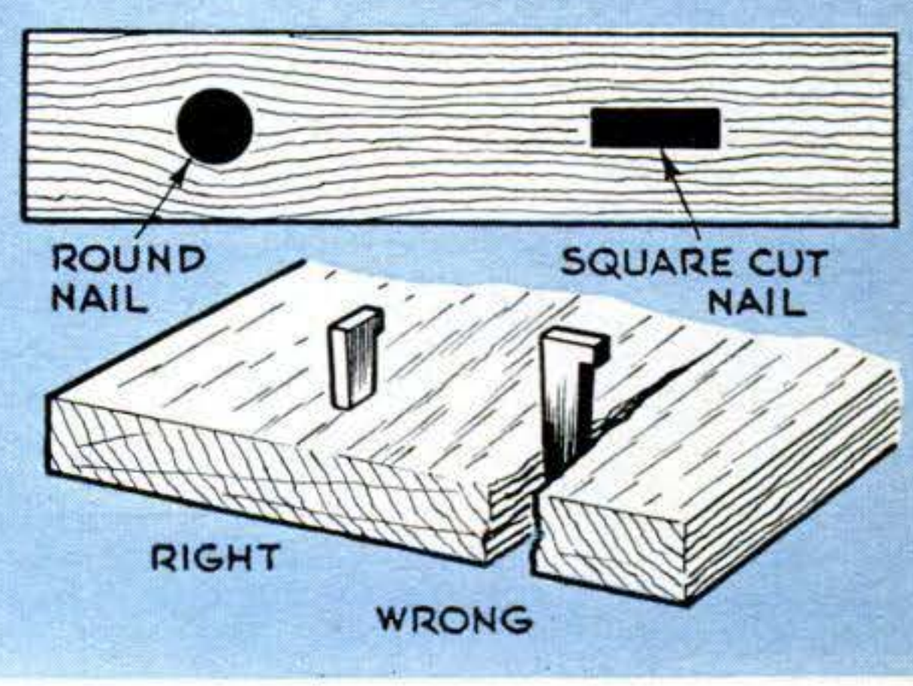
What You Should Know About CUT NAILS

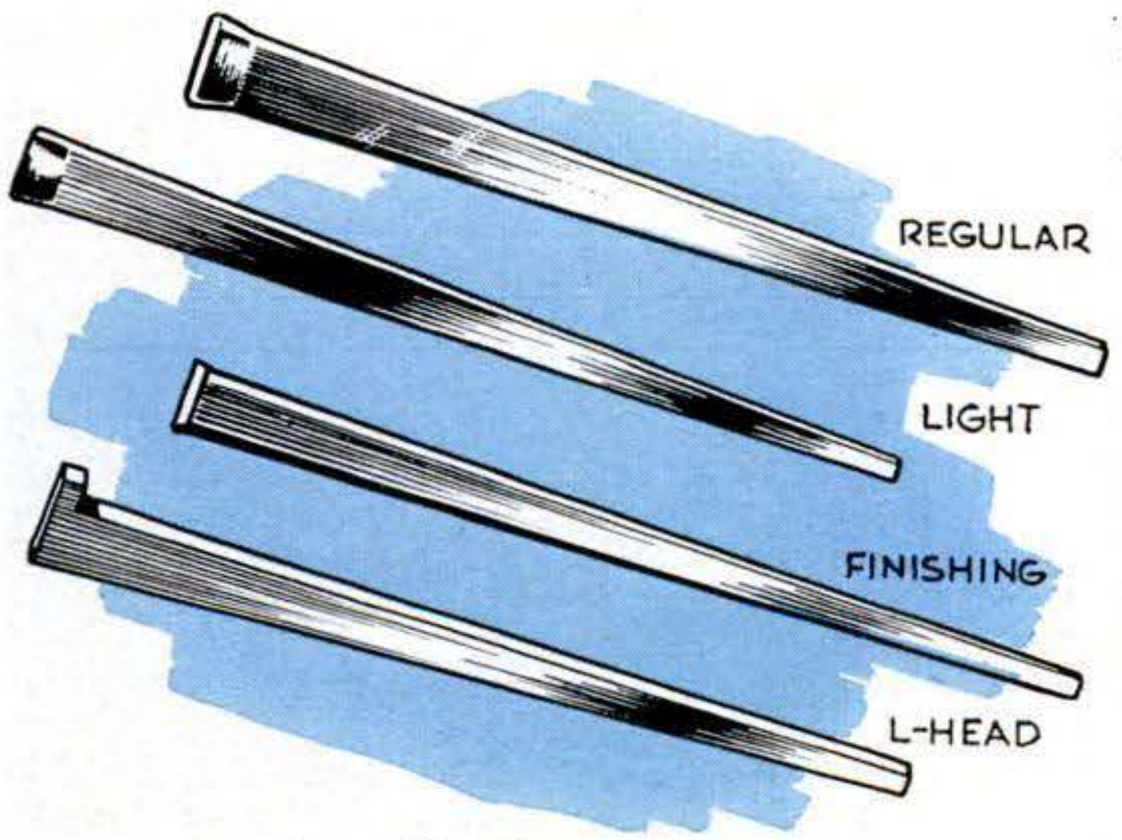
CUT nails are square-shaped, sharp-edged steel spikes designed to cut their way in without splitting and to give tremendous holding power. You can get them for laying flooring, fastening wood to masonry, and many other special jobs.

Did you know that the two most common types—flooring and masonry—are not at all alike but look so nearly identical that you can easily get the wrong one unless you buy carefully? Did you know that there are *four* types of flooring nails alone, that some nails come in two grades of hardness, that you can buy special spikes up to 6″ long for building boats? These and other surprising facts make it pay to know how to fit the right nail to the job.

How cut nails do their job

THE SHARP CORNERS of cut nails minimize splitting because they cut their way through wood, as shown at far right, instead of pushing the wood fibers apart (as pointed nails are said to do), giving the wood a chance to open up cracks. Because of their wedge shape, however, cut nails must be turned so that their long dimension runs parallel to the grain of the wood. This avoids splitting the fibers. The lower sketch at right shows the correct way to position the nail.



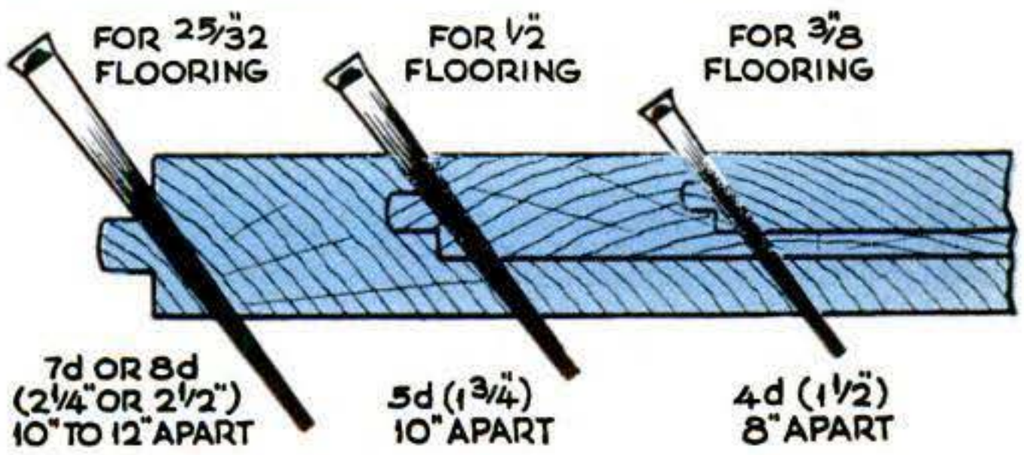


FLOORING NAILS come in four types, as at left. "Regular" is really a heavy-duty type used on gymnasium and other commercial floors. "Light" nail is most common for flooring in the home. "Finishing" nail—confusing because it isn't used for finish-nailing at all—is actually a lighter flooring nail. Its thinner shank is said to lessen splitting. Both "light" and "finishing" nails come in two grades of hardness—*regular* and *hardened*. Regular nails are used on softwood flooring, hardened nails on hardwood flooring. New "L-head" nail is said to hold 2½ times tighter without splitting because of its thin shank and broad head. Sizes of all four range from threepenny (1¼″ long) to 20-penny (4″).

Standard nail sizes

2 d . . . 1″	7 d . . . 2¼″	40 d . . . 5″
3 d . . . 1¼″	8 d . . . 2½″	50 d . . . 5½″
3½ d . . . 1⅜″	9 d . . . 2¾″	60 d . . . 6″
4 d . . . 1½″	10 d . . . 3″	70 d . . . 6½″
4½ d . . . 1⅝″	12 d . . . 3¼″	80 d . . . 7″
5 d . . . 1¾″	16 d . . . 3½″	90 d . . . 7½″
6 d . . . 2″	20 d . . . 4″	100 d . . . 8″
	30 d . . . 4½″	

What sizes to use where



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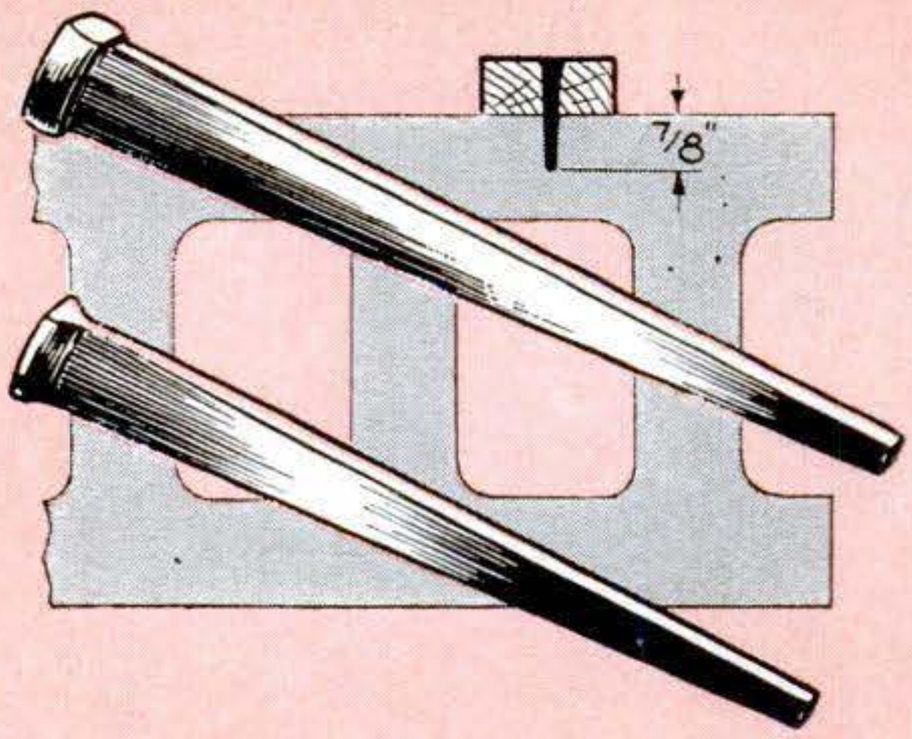

MASONRY NAILS are specially hardened so they can be driven into masonry without bending, as flooring nails may do if used by mistake. "Furring" type is made for fastening wood furring strips to concrete-block walls. "Cornice" type with large head is used where cornices and wood trim must be attached directly to masonry. Masonry nails should be just 7/8" longer than wood is thick, as shown in the sketch at left. This gives the nail maximum holding power without chipping out the inside of the block. Sizes for furring nails range from four-penny (1½") to eight-penny (2½"); for cornice nails, the range is four-penny to 20-penny (4").

Other types of cut nails and what they're used for

Not all of the nails shown in the chart below are commonly available, but they can usually be obtained through lumberyards and building-supply houses. For large jobs, they can be purchased in 100-pound kegs. The examples shown here are La Belle cut nails, made by the Wheeling Corrugating Co., Wheeling, W. Va.

BOAT NAILS come in unusually long lengths (up to 6") and offer an easy way of spiking together simple, yet sturdy, wood boats, such as rowboats and skiffs. Smallest size is 1½".

HINGE NAIL has a broad round head and is made for spiking heavy strap hinges to fence posts. It can also be used as a clinch nail where the point is bent over, and for this reason is made of soft carbon steel. Sizes are 1½" to 4".

FENCE NAIL has a very heavy body and is made especially for securing wood fence rails to hardwood posts. It can also be used for spiking heavy planks and timbers. Sizes range from five-penny (1¾" long) to 20-penny (4").

COMMON NAIL is equivalent to similar sizes of common wire nails and is used for the same general construction jobs. A hardened version is sometimes used to attach furring strips to concrete block, although it is generally better to use a furring nail for this. Sizes are 1¼" to 6".

BOX NAIL is the same style as the common nail but slightly thinner. It is used on general construction, especially where it is important to minimize splitting. Sizes range from three-penny (1¼" long) to 20-penny (4").

SHINGLE NAIL has a large flat head made for holding down wood and composition shingles, and is galvanized to prevent rust. It is also known as a "roofing" nail and can be used to put down roll roofing. Sizes range from 3½-penny (1⅜" long) to seven-penny (2¼" long).

SIDING NAIL, made for attaching house siding over sheathing, is specially hot-galvanized to prevent rust stains from running down the walls. Sizes are 2" to 3".

FINE FINISHING NAIL is not the same as the regular finishing nail made for laying flooring. It is thinner and can be used wherever a slim, lightweight nail is required. Sizes range from three-penny (1¼") to 20-penny (4").

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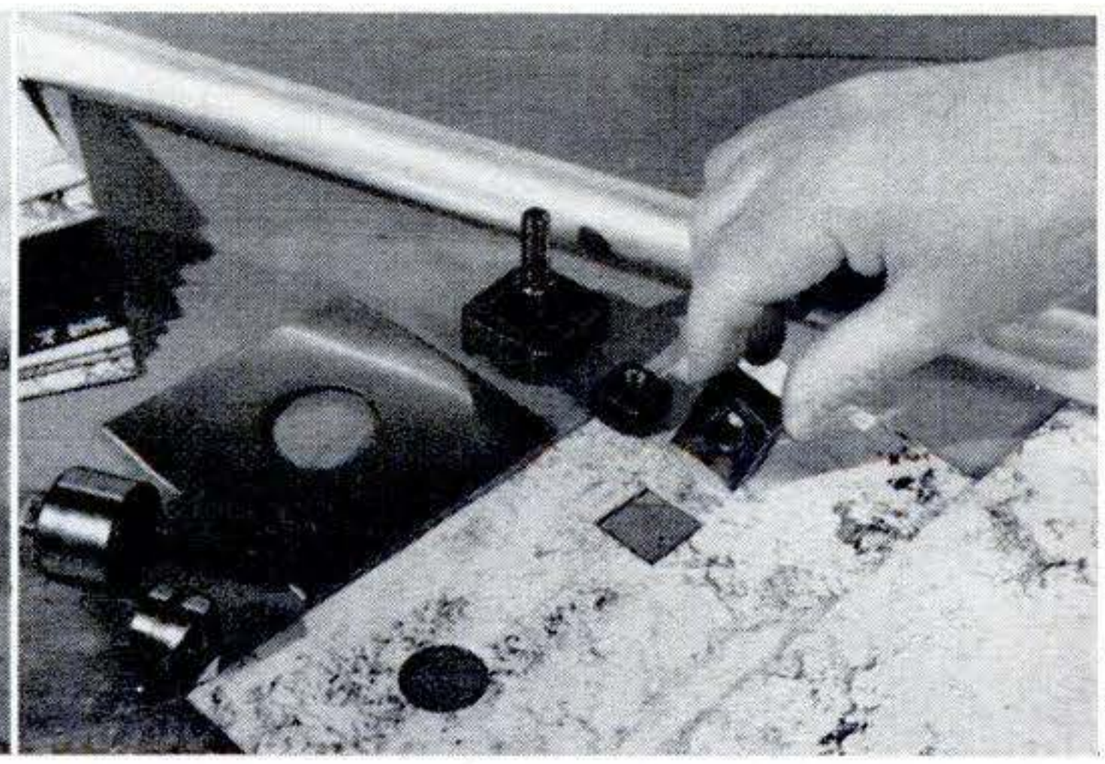
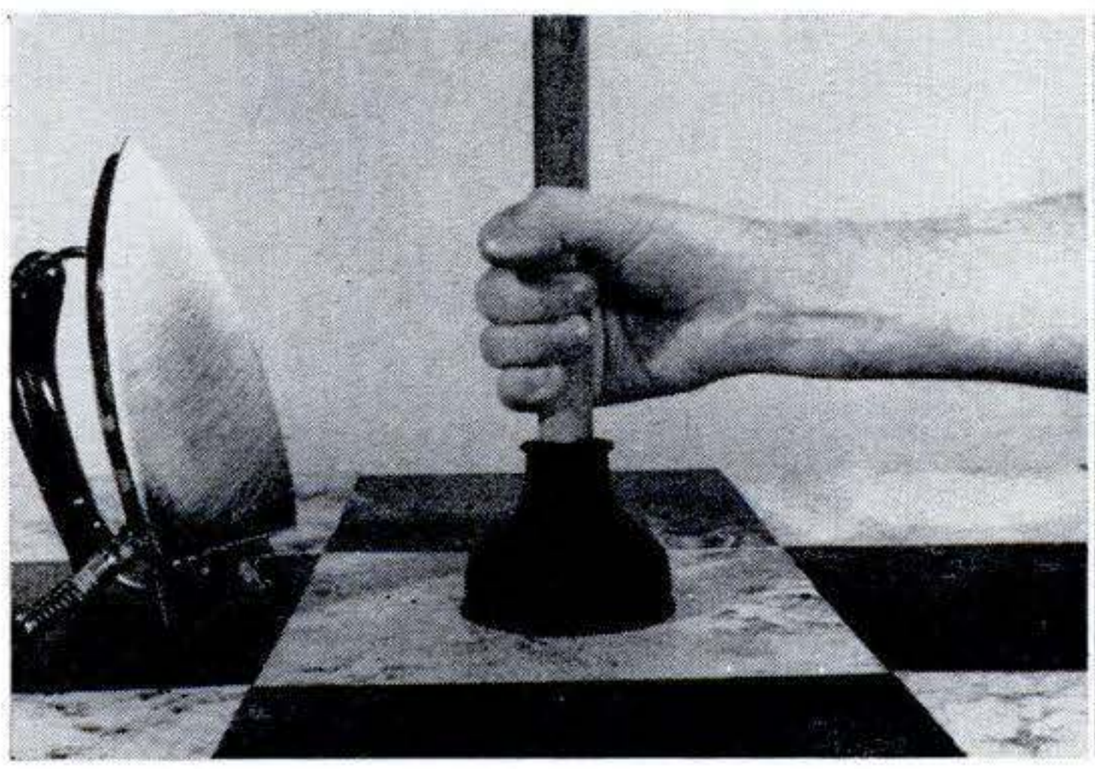
Tips on Laying Resilient Tile

know-how file

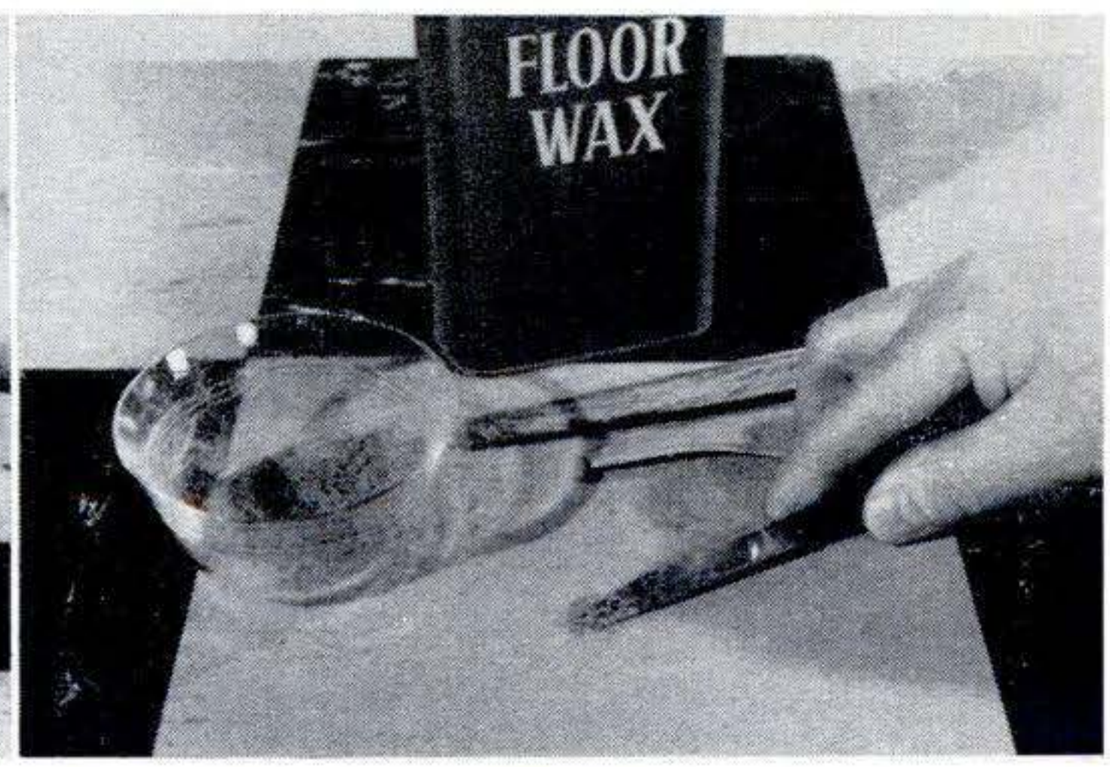
PROTECT THE FACE of tiles from adhesive stains during installation by wiping on a thin coat of wax first. Then troublesome spills and squeeze-outs can be wiped off the surface easily.



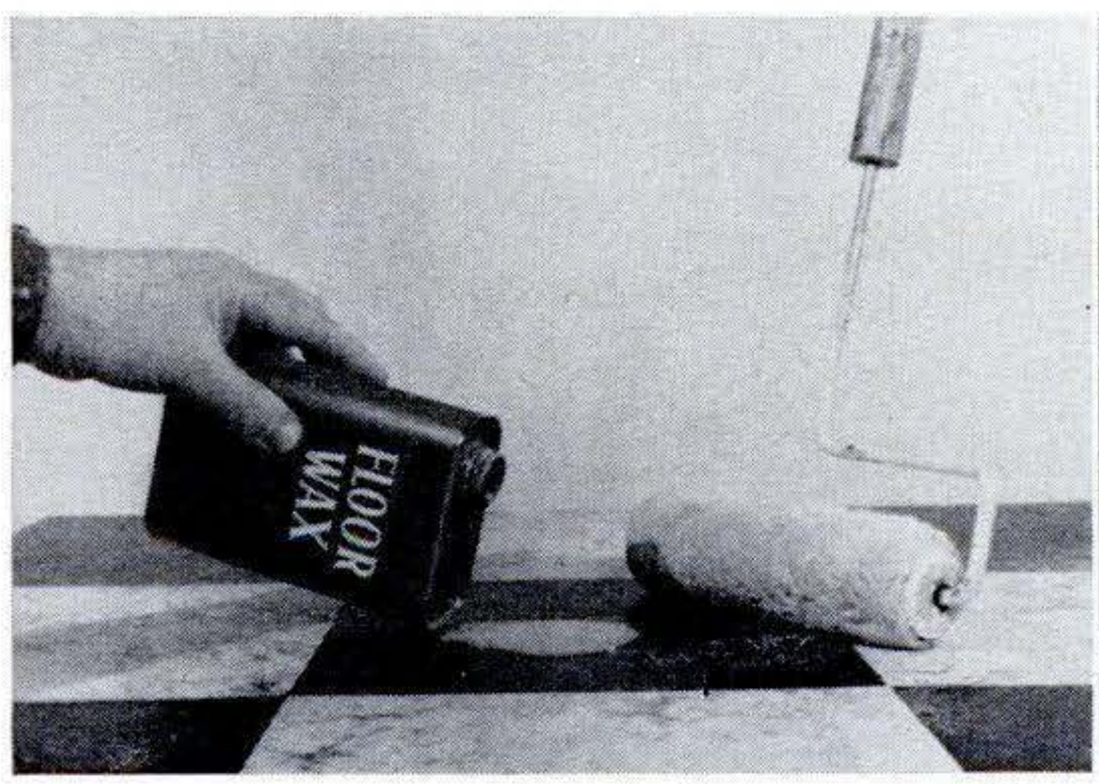
CHASSIS PUNCHES borrowed from a radio repairman cut neat pipe holes through tile that's warmed. Slit the punched tile from the hole to an edge so you can slip it around the pipe.



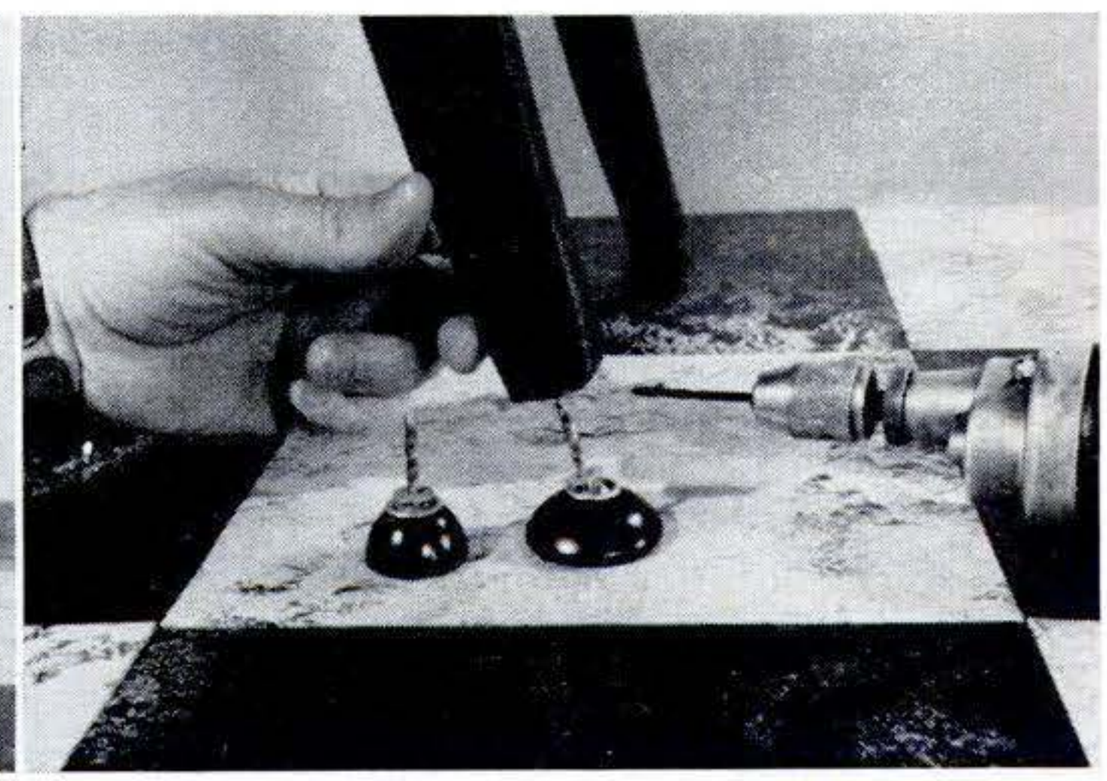
FAULTY TILES in a finished floor can be replaced. Warm a damaged, unevenly laid, or mismatched one with an iron and pull it up with a suction cup that's been dipped in soapy water.



FINISH THE JOB PERFECTLY by filling any accidental nicks or dents. The filler is made of tile filings mixed with wax. Force this "putty" into the hole. Then clean face of the tile.



LET CEMENT DRY two days before waxing tile. Paint roller with broomstick handle eases application. On asphalt, rubber, or cork tile, use water-soluble wax. Use no wax on vinyl.



AVOID FUTURE DENTS by attaching broad plastic rests to all furniture legs—they spread the weight better. Predrill a hole for the screw kind; a snap-in type is made for metal legs.

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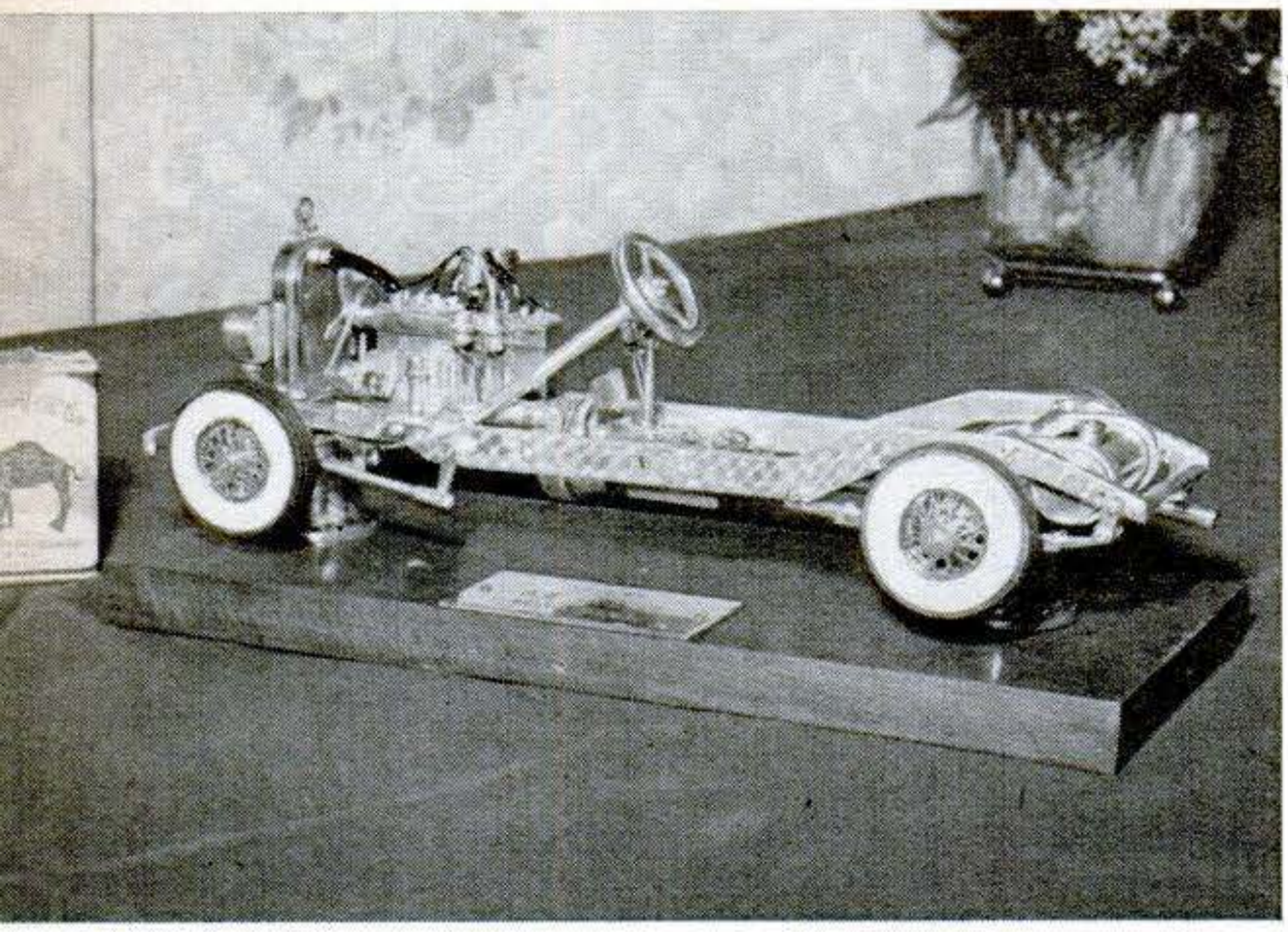
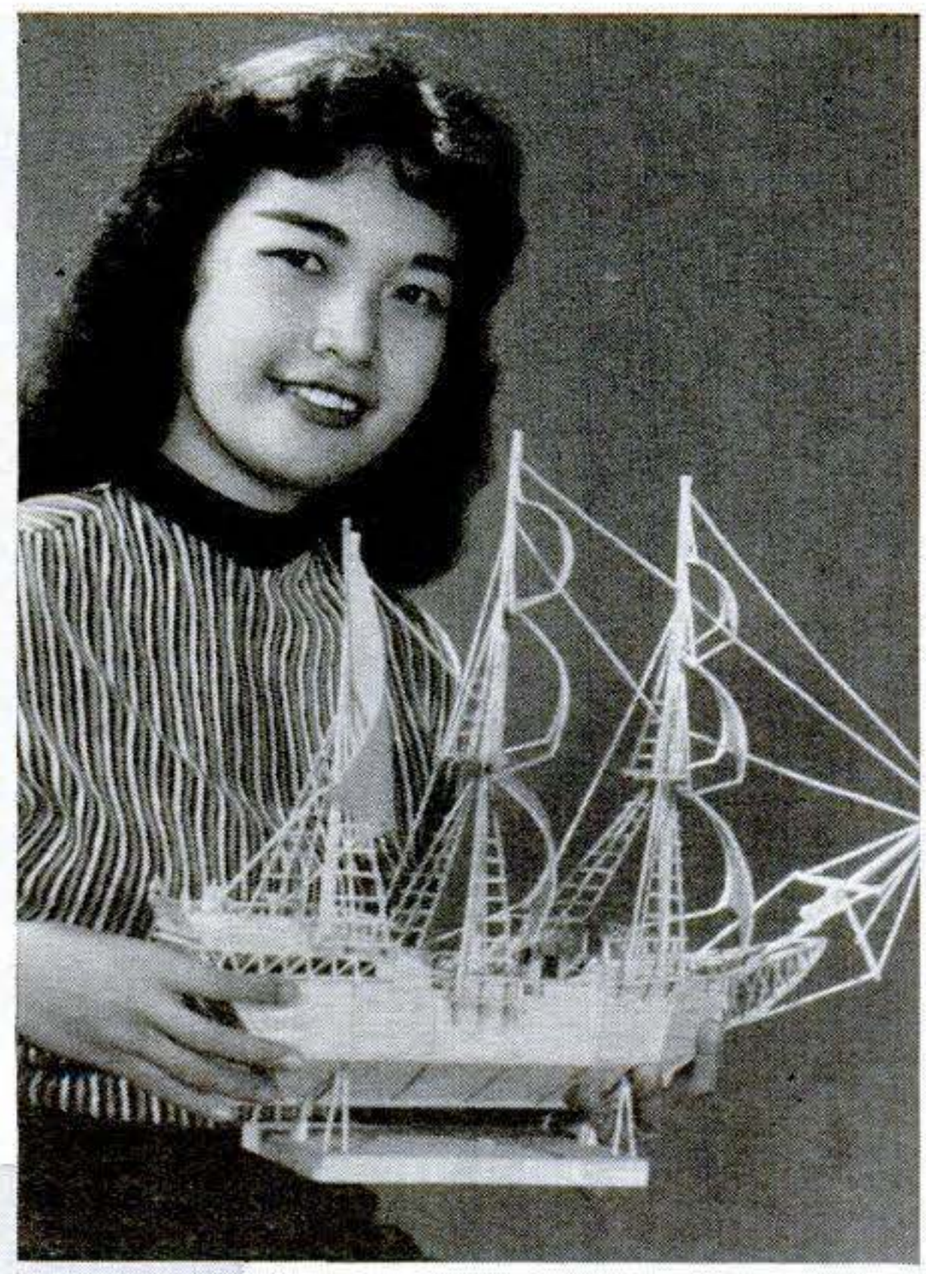
My PRIZE project is...



...a classic car chassis

THE wheels turn and the steering gear operates on this scale model of a Stutz Black Hawk chassis. I made it of aluminum and mounted it on a mahogany base. The cigarette pack shows how big it is. The engine is a dummy, but like the rest of the chassis, it's accurately detailed.

A. E. LOEHR, Belvedere, Ill.



...a ship model

IT'S made from matches. I cut off the heads and cemented the sticks together, one by one. After I'd completely formed the model, I sanded it smooth. The job took about 20,000 matches and eight months of spare time. It placed third in the arts and crafts contest for Filipinos held at Clark Air Force Base. In the picture, my friend is holding the model. Nice, isn't she?

C. P. TRIAS, Rosario, Cavite, P. I.

...a pool table

IT'S complete with ball rack and triangle. I designed and built the whole outfit myself—except for the cues and balls—when I was 16. The sides are walnut-finished pine, and the top is felt-covered hardboard. That's me making a shot while brother Blaine looks on.

RICHARD ANDERSON
Friend, Neb.

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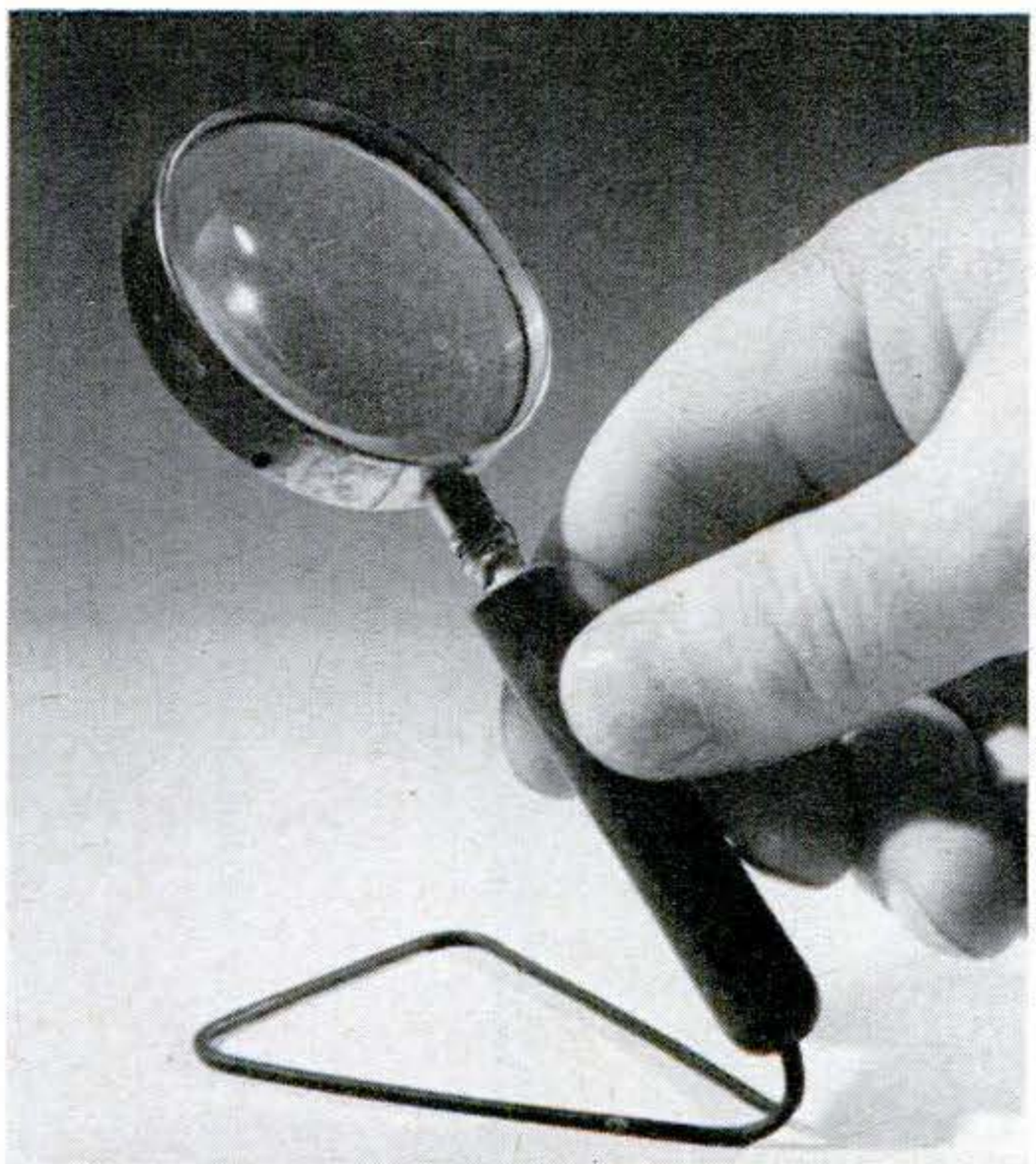


Short Cuts and Tips

FROM PS READERS

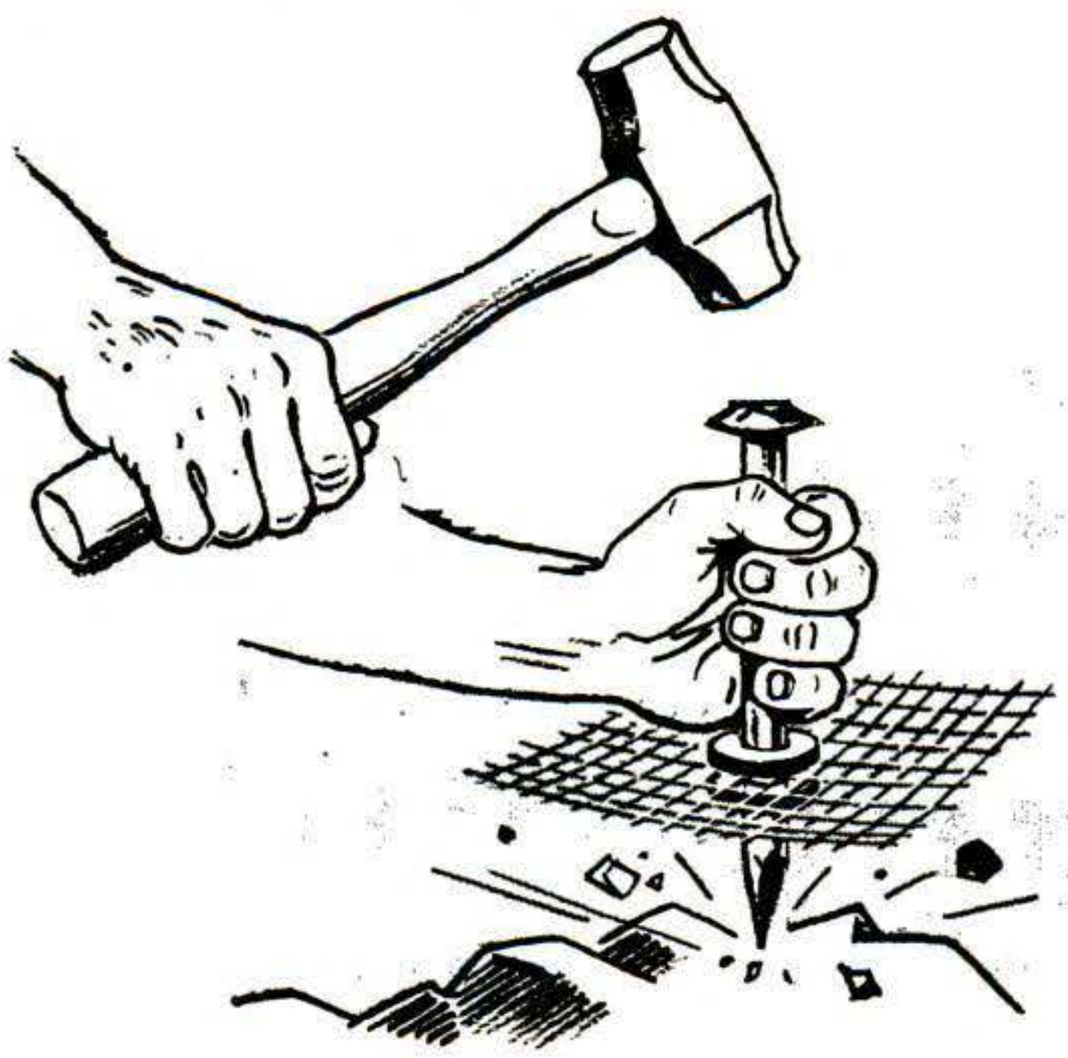
Stand-Up Magnifying Glass

BOTH hands are left free when a hand magnifier is equipped with this simple support. Form it from stiff wire and bend the ends at an angle so that they can be pushed into a hole drilled in the handle.—*Ken Murray, Colon, Mich.*

▶▶▶DON'T throw away that old dried putty in the bottom of the can. Drain off any oil, remove the putty, and place it on a hard board. Then beat the lump with a hammer, adding a little oil gradually. —*Donald H. Walton, High Point, N. C.*

Converting Flash to Spotlight

TO AVOID light spread when you use a flash extension for backlighting, turn it into a spot. Cut a piece of thin hardboard to fit the reflector and insert an empty fruit-juice can into a center hole. Paint the inside of the can black. Two screws with nuts and washers, near opposite edges of the disk, permit temporary attachment. Just slip the washers over the reflector.—*C. Martin, Detroit.*



Chisel-Chip Safeguard

PROTECT yourself against flying chips when you use a chisel, by slipping the tool through a hole in a square of wire screen. Anchor the screen to the chisel with a pair of tight-fitting rubber washers cut from an old inner tube.—*Leslie K. Schultz, Berwyn, Ill.*

▶▶▶THE average home owner may not have a suitable container to mix mortar. I solved the problem by using a garbage-can lid. It held water without spilling, and was easily moved from sandpile to working area. A little water after the job, and the lid was as clean as ever.—*Arthur J. Harris, Baton Rouge, La.*

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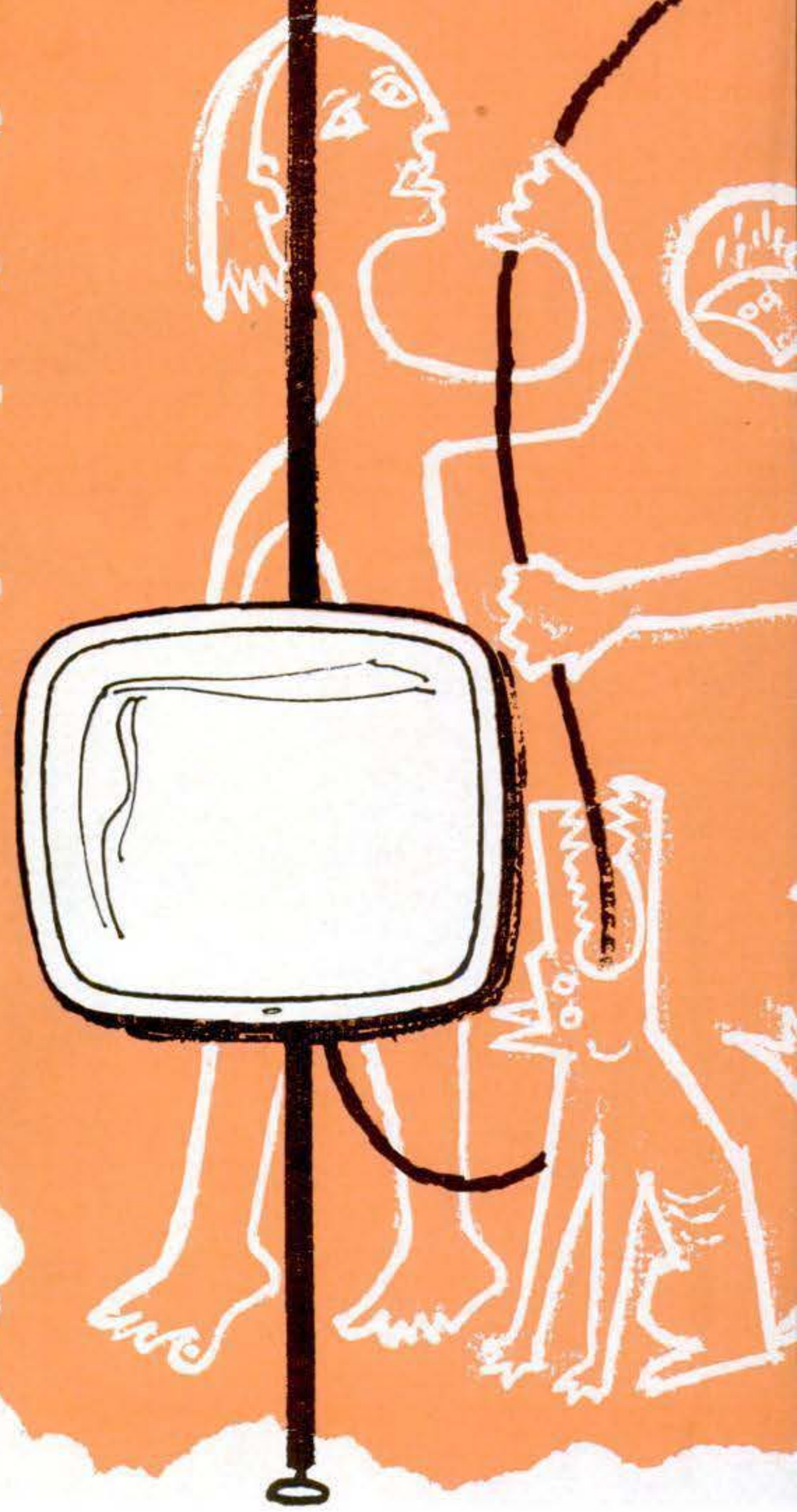
Trouble-shooting adventures from the notebook of a repairman, or—

The Case of the Yellow TV Coil

By Art Margolis



He waved my objection aside with an imperious gesture. "Change it!" he said.

Some day I'm going to write a book about the characters I've met in my work. They're about as varied as the TV troubles I'm called to fix. I thumbed through my notebook the other day and selected two cases at random. Here they are:

THE modern house was mostly glass. I pushed my hat back on my head and looked for a door. In the middle of one opaque panel hung a metal object the shape of a human ear. On the chance that it might be a knocker, I lifted it.

Chimes sounded inside and a voice came out of nowhere. "Who's there? Speak into the ear, please. It's a microphone."

"TV man," I said, keeping my voice normal. The panel slid aside, revealing a bearded man wearing a white artist's smock and beret to match, and holding a foot-long cigarette holder in one hand.

As the door closed itself behind me, he crooked a finger to indicate that I was to follow him. I'll skip the furnishings because describing an abstract nightmare is beyond my ability. We entered a smaller room where I was faced with a wall that made me gasp. I did a double-take. What at first had appeared to be a mixed-up mural resolved itself into a crazy TV set. The picture tube was in one corner. The printed-circuit chassis was placed vertically dead center. Tubes pointed out at me.

"How do you turn this thing on?" I asked.

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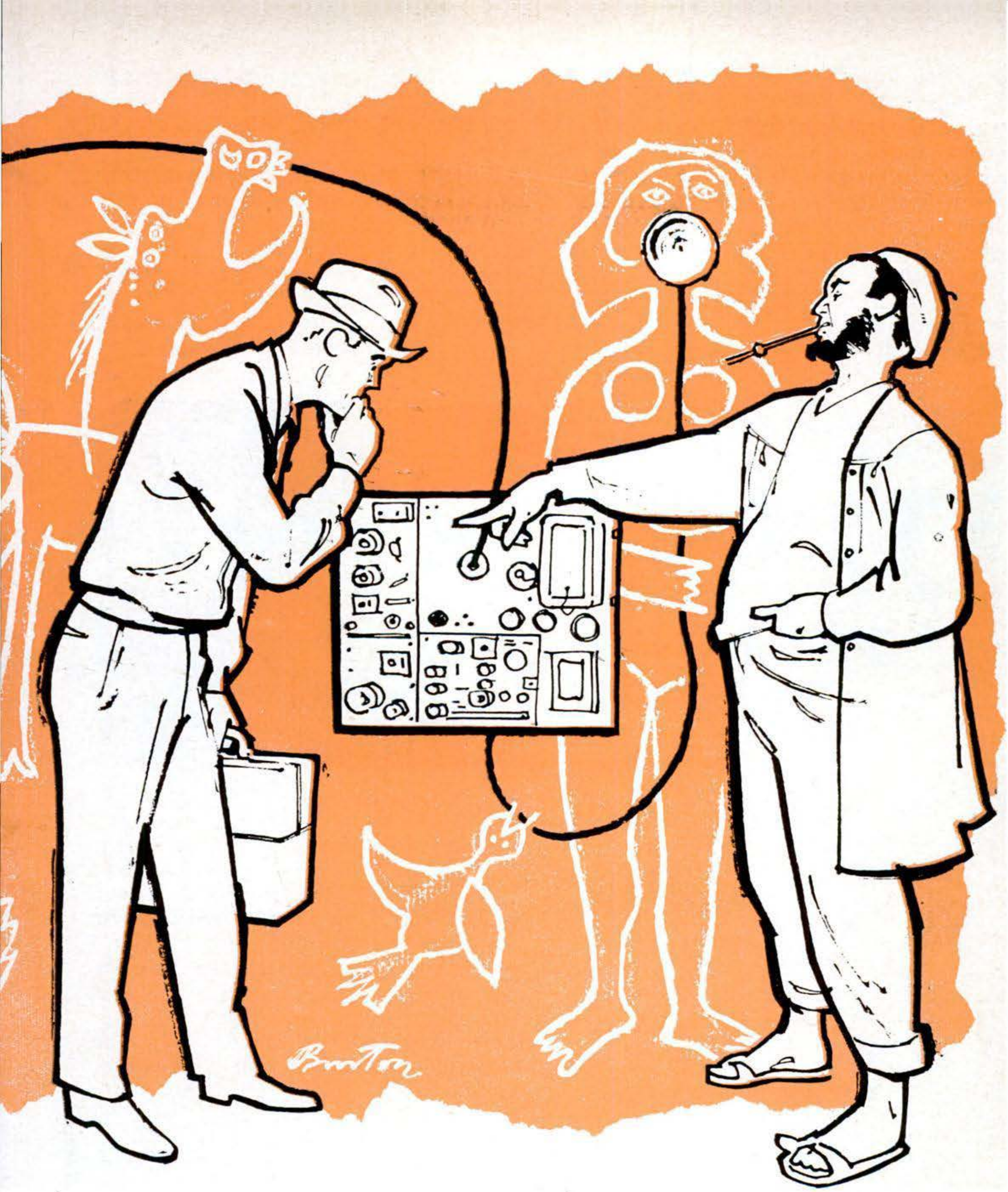

"Never mind that," said the bearded man. He went over and pointed to the horizontal oscillator coil. It was painted a bilious yellow. "Change it!"

I explained that I'd like to examine the set first. He waved my objections aside with an imperious gesture.

"Change it!"

"Okay, mister," I said, getting to work. "It's your set."

The coil was mounted on the printed-circuit board with four connections. In the factory these four connections are soldered simultaneously by dipping the board into liquid solder. I carry no liquid solder and only one soldering iron. My problem was how to heat all four connections at once with one iron.

The solution was simple. Taking a piece of No. 10 copper wire from my tool

CONTINUED

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box, I wrapped one end firmly around the tip of the soldering iron. The other end of the wire I formed into a loop that would touch all four connections. I plugged in the iron. It became hot, transferred heat to the wire. Then I placed the wire so that it touched all four joints. The solder melted. I tugged at the coil and it came free.

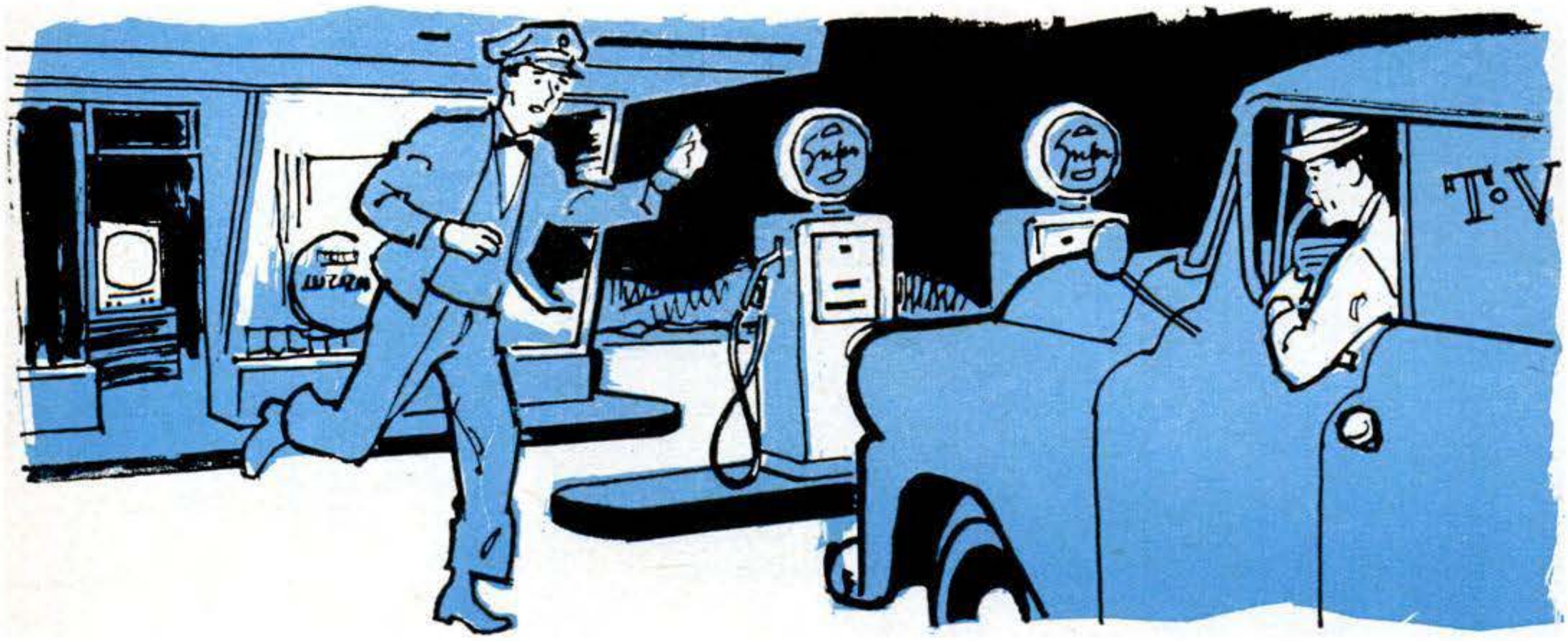
Fortunately I had a replacement coil with me. I inserted it into the holes and put a bead of solder on the four connections. Sound came on fine, picture perfect.

"What was wrong with the set?" I asked.

The character in the smock was beaming. "There was no brightness," he said.

"Well," I told him, "I guess the coil replacement cured that. But how did you know what part was causing the trouble?"

"I didn't," he said. "I just had to get rid of that atrocious yellow. It clashed horribly with the decor of the room."



The Fickle TV Fan

THE sound of shooting greeted my ears as I pulled up to the gas-station pump. I had to honk my horn three times before Hank came out.

"Sorry, Art," he said. "I was watching a Western on television and didn't see you. Fill 'er up?"

"If you can spare the time from your TV. Something new, isn't it?"

"That's right. Got it in trade for that jalopy I've been souping up."

When I'd had the free treatment that goes with a tank of gas, Hank asked me to come inside. "Want you to take a peek at the set. The audio has conked out twice this week."

It was blasting good and loud. Nothing wrong that I could see, so I told him that I'd better pull the chassis and take it along for a leisurely check. His face fell. You'd have thought I was threatening to take his best girl away.

"Have a heart, buddy. The sound only goes blooey once in a while. Can't you try and fix it here?"

"No, I can't, Hank. But if you want to help . . ."

"Sure thing, Art. Just tell me how."

I made out a chart for the five audio tubes, listing all the pin numbers and the voltages that were supposed to be on each during normal operation. Then I gave him a voltmeter. "Take readings when an audio attack comes on," I said, "and compare them with the chart."

Ten days later he called. During an attack the voltage on pin four, which was supposed to be 300 volts, had dropped to zero. I told him to wait for another attack and then measure the resistor between pin four and its voltage source. I suspected that this resistor was opening up. Hank's next report proved that it was—measuring infinite ohms. I went over and replaced the resistor.

Two weeks later I pulled into the gas station to hear a racket like the firing of a machine gun. It stopped and Hank came running out from behind the office.

"Fill 'er up?" he asked.

I nodded. "How's the TV behaving?"

"Don't know, Art. You see, I traded it in for an old motorcycle, and from the way she sounds I suspect . . ."

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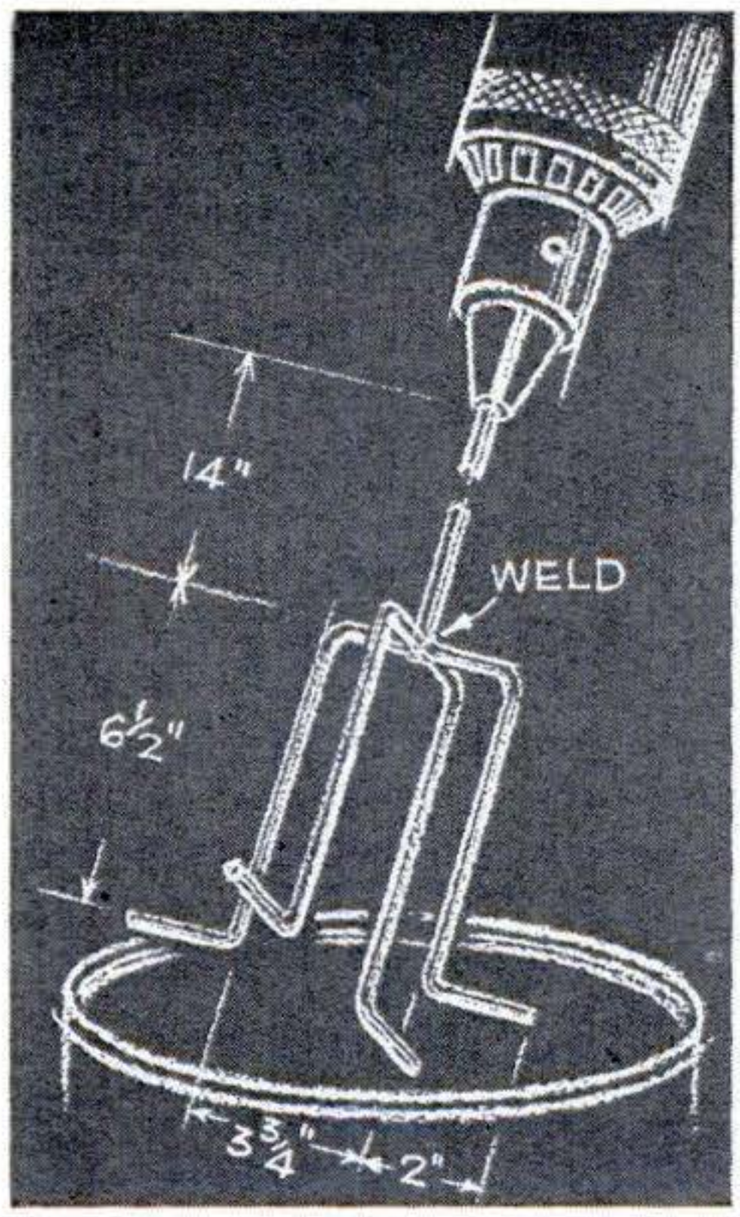
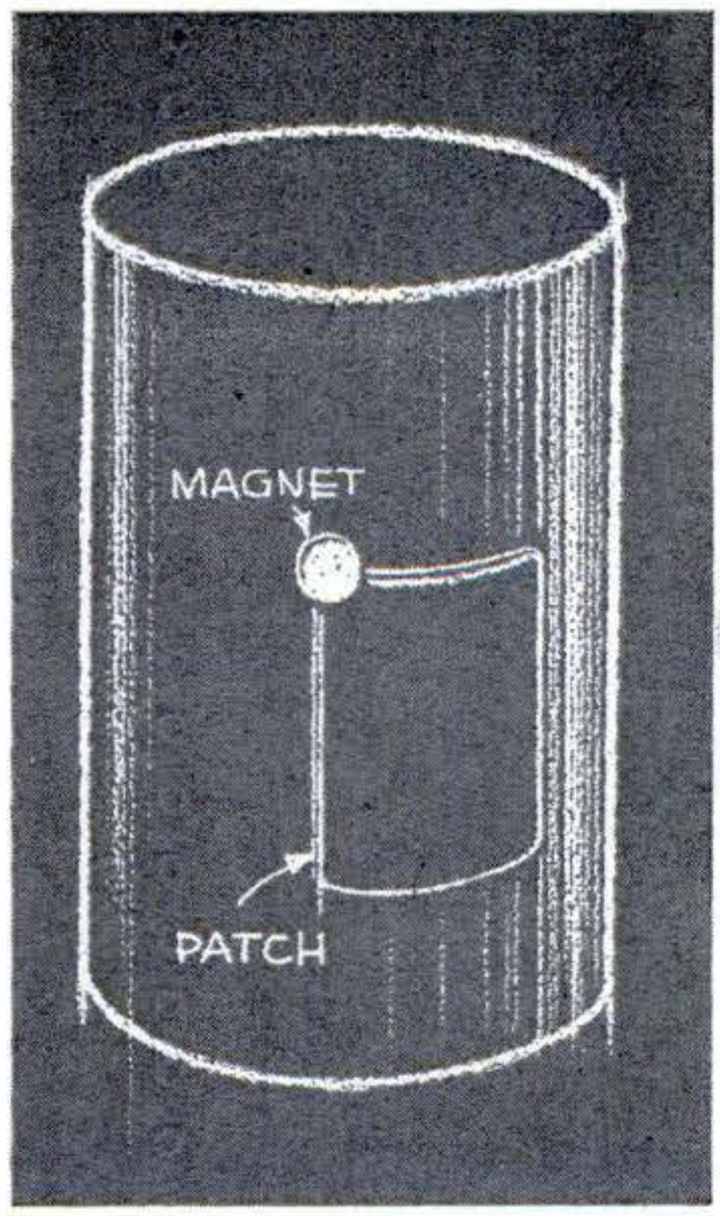
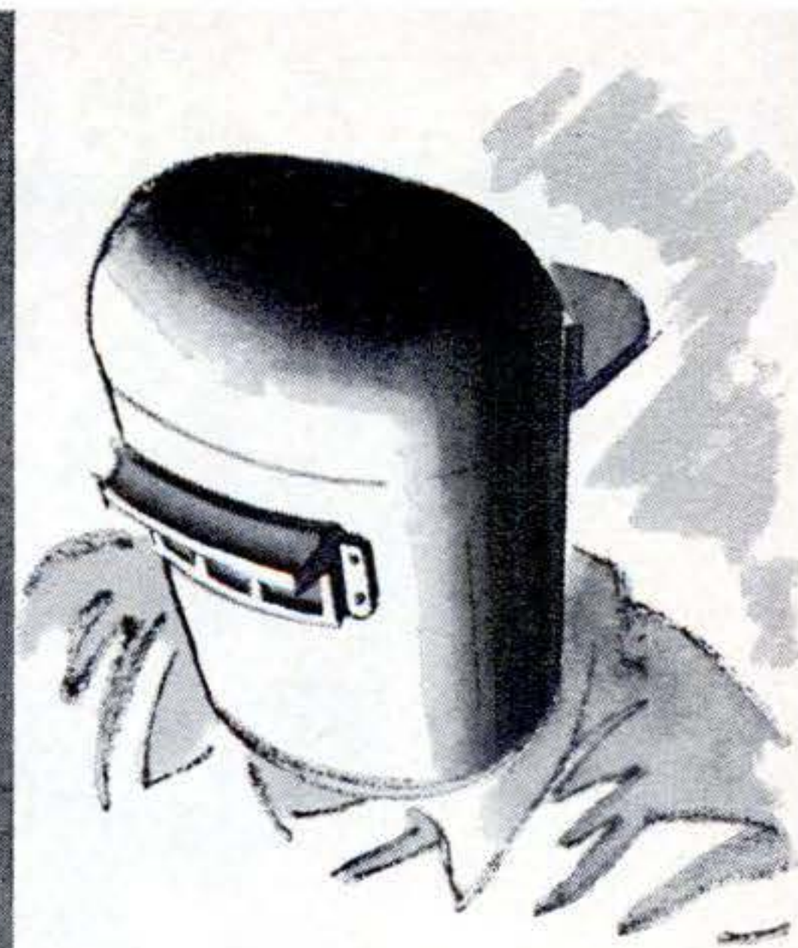


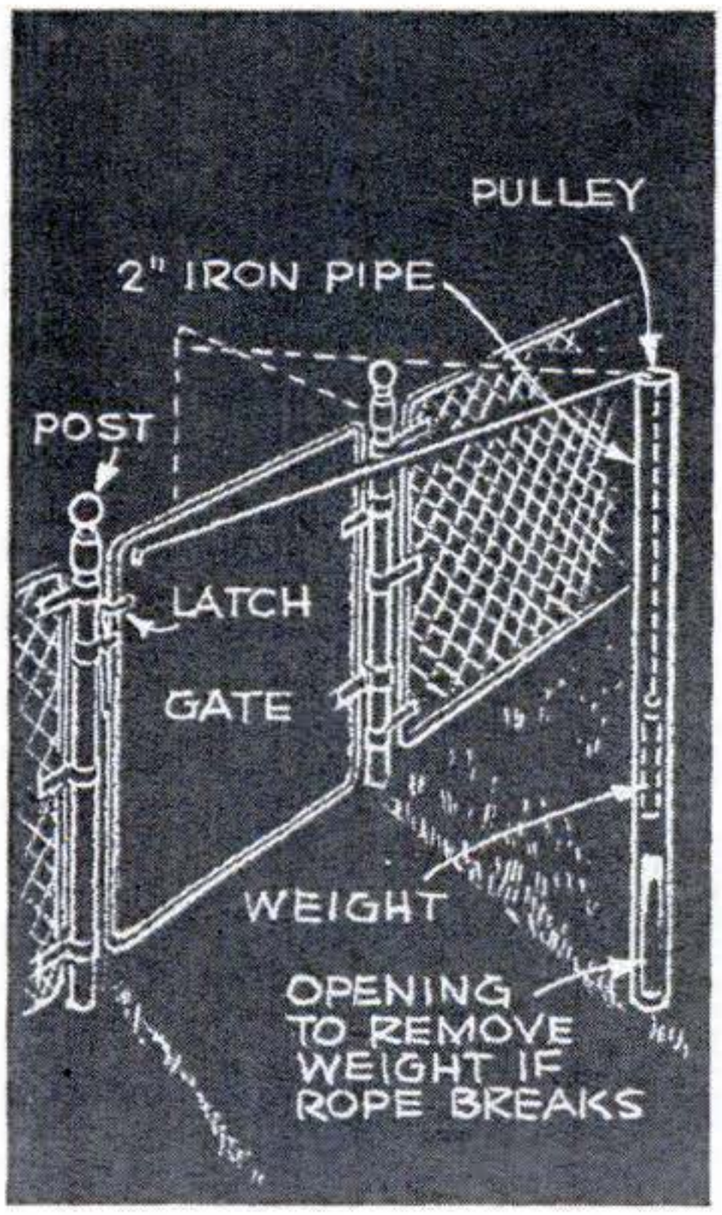
SPEED CEMENT MIXING with a homemade "beater." I made mine for an electric drill. It's bent to the dimensions shown from ⅜" rod, then welded together. Chucked in a ½" drill, it mixes two gallons of cement in a jiffy in a five-gallon bucket. —*Jerry Thomas, Camden, Ind.*



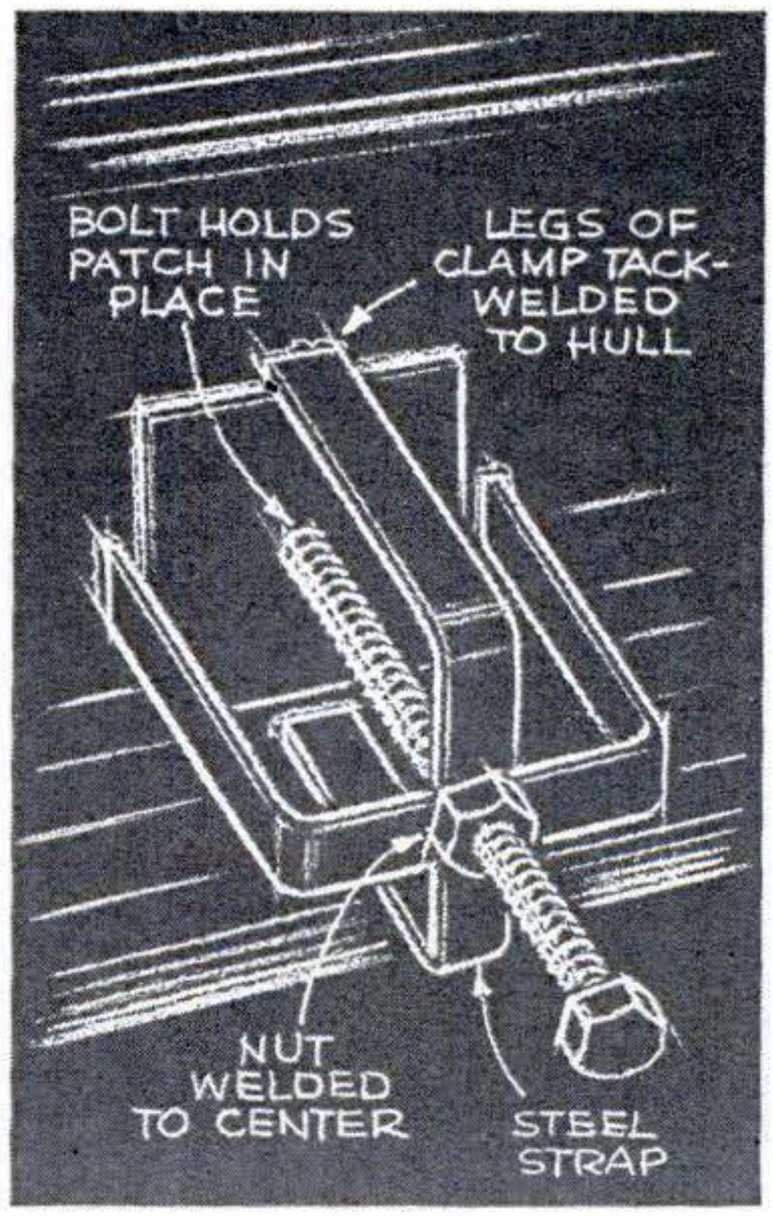
TO HOLD A PATCH on a vertical surface while it's being welded, I use an ordinary radio-speaker magnet of the permanent type. The magnet holds small patches securely to the surface and saves a lot of work with complicated clamp setups.—*Pete Lieuwen, New Holland, S. D.*



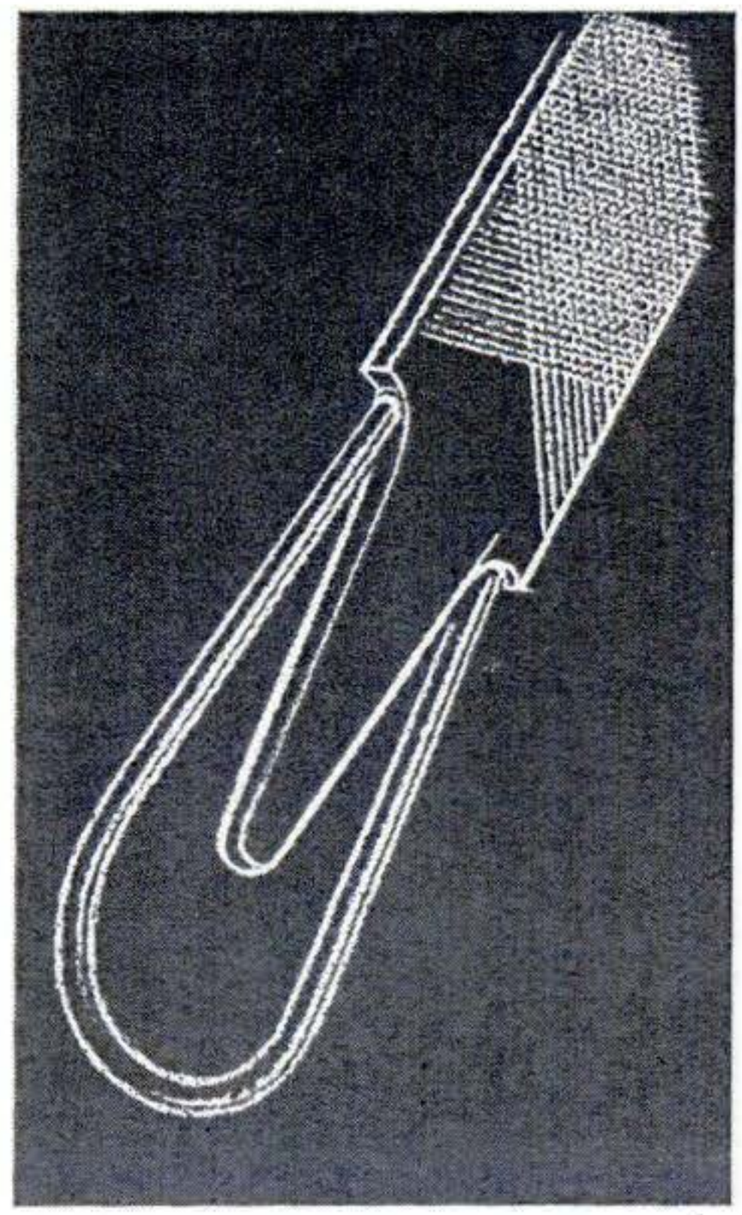
For the Man Who Can Weld



A SELF-CLOSING GATE can be made with a sliding weight arranged as you see in the sketch above. I welded a pulley at the top of a 2"-pipe post. The weight rides up and down inside the pipe, pulling the gate closed as it makes the descent.—*C. S. Fiduccia, Covington, La.*



REPAIRING METAL BOAT HULLS has been much easier since I made this patch clamp. Two U-shaped pieces of strap are welded crosswise with a nut for a bolt. The clamp is tack-welded to the hull, then cut off after the patch is welded.—*John Florence, Oswego, N. Y.*



PUT HANDLES ON YOUR FILES by welding on loops of rod this way. They're comfortable and make it easy to hang up the files. —*J. Rzeszutek, Minneapolis.*

All tips on this page were adapted from The Stabilizer, *published by Lincoln Electric Company.*

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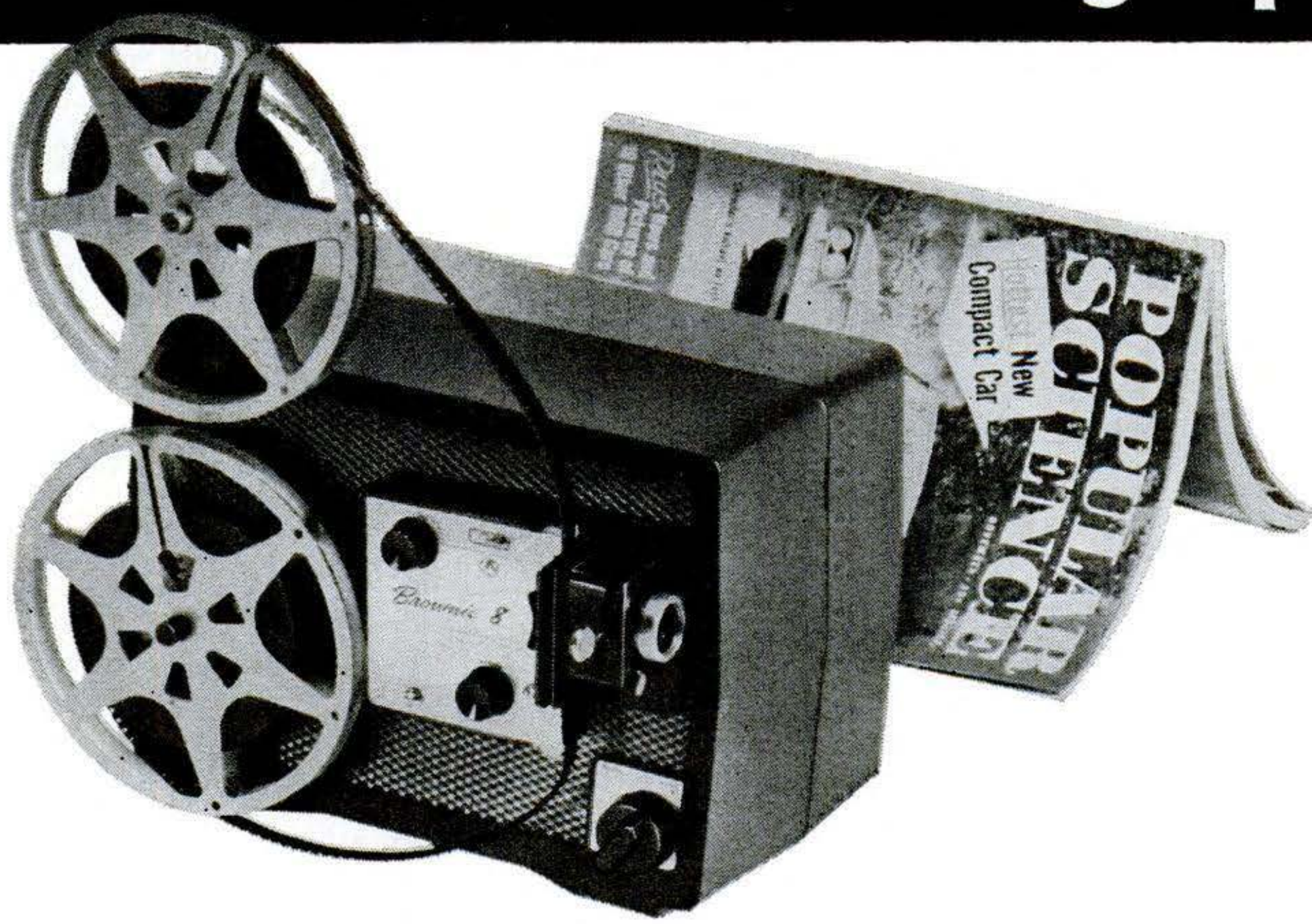
New Ideas in Photography



Now a Movie Projector as Small as This Page

—yet it shows beautiful movies a yard wide

Here's the latest word in compactness for 8mm home movies. The Brownie 8 Movie Projector stands only 9″ by 6½″ (this page size) by 6″, and weighs only 5½ pounds.

But don't let its small size fool you. It performs big in every way.

At just 12 feet from your screen, this projector shows movies three feet across. The secret is a new-type lamp with its own non-tarnishing, electronically prefocused reflector to assure maximum brilliance.

Loading is simple because there are no sprockets. You can actually thread the film while the projector is running. The projector accepts big 200-foot reels for full 15-minute shows. And it is blower-cooled.

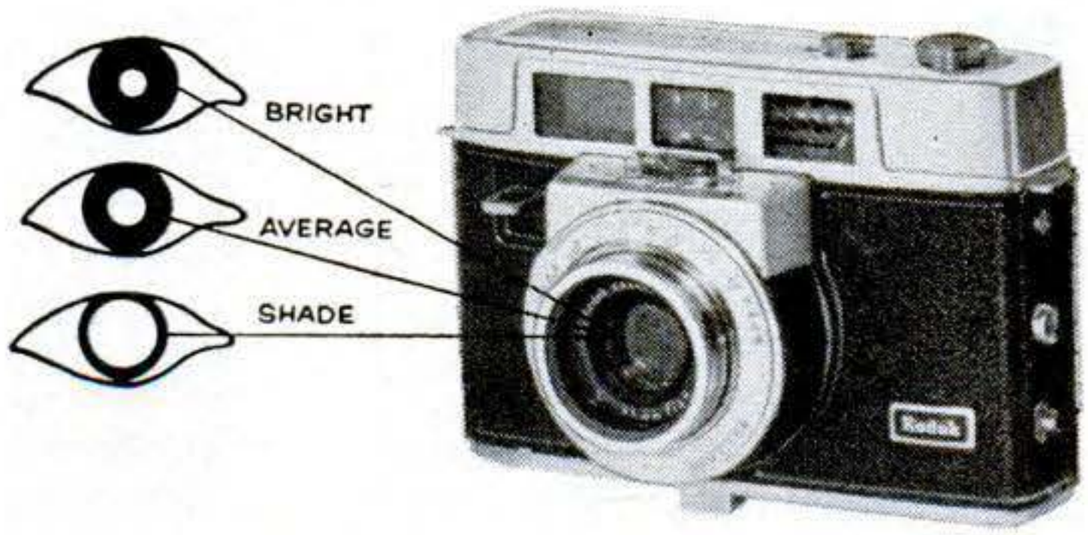
It's worth a trip to your dealer to see the Brownie 8 Movie Projector in action. The price: only $44.50, or as little as $4.50 down.

Lens Automatically "Squints" in Sun, Opens in Shade Like Human Eye

Now Kodak has built an automatic 35mm camera that works much like your eye. It sees light and sets its own lens opening.

The "brain" in the Kodak Automatic 35 Camera is a photoelectric meter. Light reflected from your subject moves a control needle which determines the lens opening. The result: correctly exposed pictures time after time!

Change shutter speed, and an automatic switch adjusts the meter and lens response. If light is too dim even for the *f*/2.8 lens, an automatic signal tells you to use flash. You don't even thread film —just drop it in!



Try for yourself all the swift, easy operating features of this camera . . . the single-stroke film advance . . . the click-stop "zone" focusing. Only $84.50, or $8.50 down.

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from Kodak

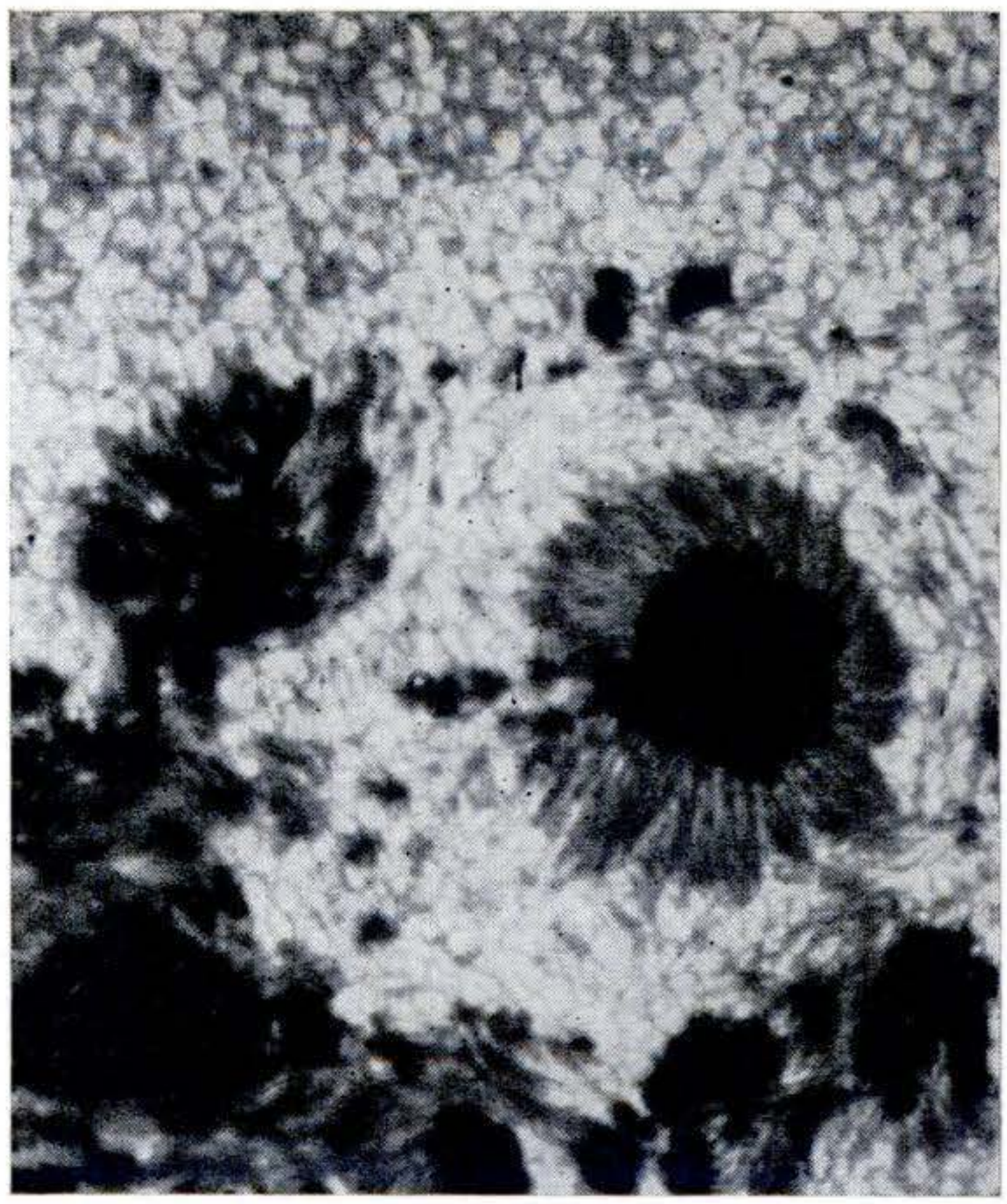
Spots on Sun Filmed for Clues To Radio Disturbances on Earth

Film—in a giant 35mm tele-camera—is bringing astronomers new facts about how happenings on the sun affect us here on earth.

Sunspots cause interference in long-range radio communications. They are being studied through thousands of 35mm photographs of the surface of the sun—taken by a telescope-TV camera system. Kodak films designed for astronomical and professional movie work are being used.

To get the pictures, the radio-controlled photographic equipment was carried by balloon to an altitude of 80,000 feet. This eliminated the shimmer and poor visibility caused by the earth's atmosphere. As a result, the pictures are far more detailed than any ever obtained by even the most powerful ground telescopes.

And the most searching pictures were taken on Eastman Background-X Film, a close relative of the famous fine-grain Kodak Panatomic-X Film used by amateur and professional photographers.



Pictures of sunspots reveal dark cores of relatively cool gases embedded in strong magnetic fields. Surrounding the cores are wispy filaments of outward-moving warmer gases. The sunspots shown here produced a magnetic storm on earth the day before the picture-taking flight.

Versatile Slide Projector Lets You Use Any of 3 Changer Systems

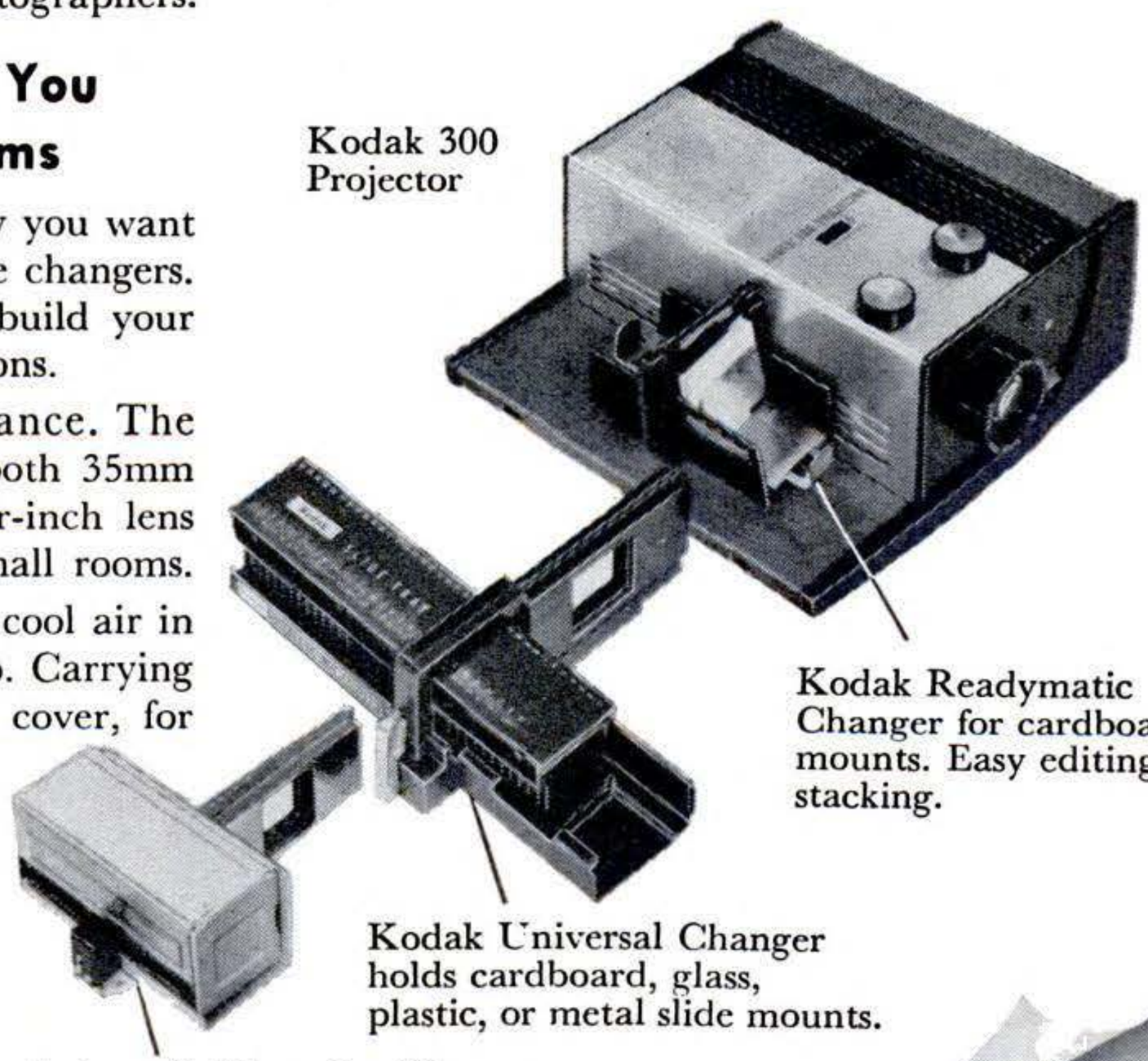
Mount and store your slides any way you want . . . choose any of three kinds of slide changers. This Kodak 300 Projector lets you build your color-slide collection without restrictions.

And it gives you great performance. The efficient lamp and condenser show both 35mm and super-slides brilliantly. The four-inch lens permits big-screen images even in small rooms.

A quiet, turbine-type blower pulls cool air in over your slides and around the lamp. Carrying handle is on the projector, not the cover, for extra safety. Cover snaps on—no extra carrying case to buy.

With Readymatic Changer and 4-inch lens, Kodak 300 Projector, $64.50; Kodak 500 Projector with extra margin of brightness, $74.50. Look at both before you choose.

Prices are list, include Federal Tax, and are subject to change without notice.



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SEE KODAK'S "THE ED SULLIVAN SHOW" AND "OZZIE AND HARRIET."

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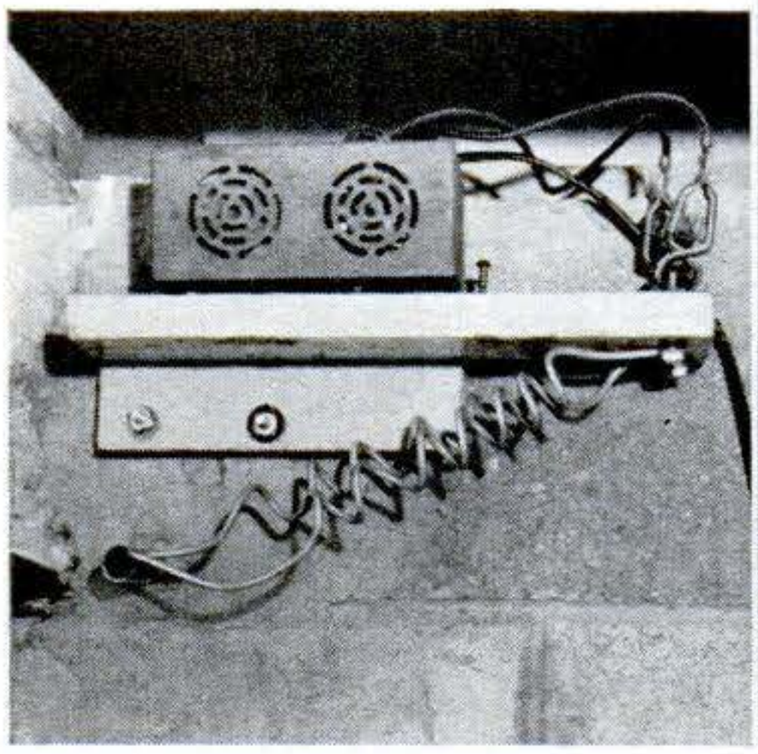
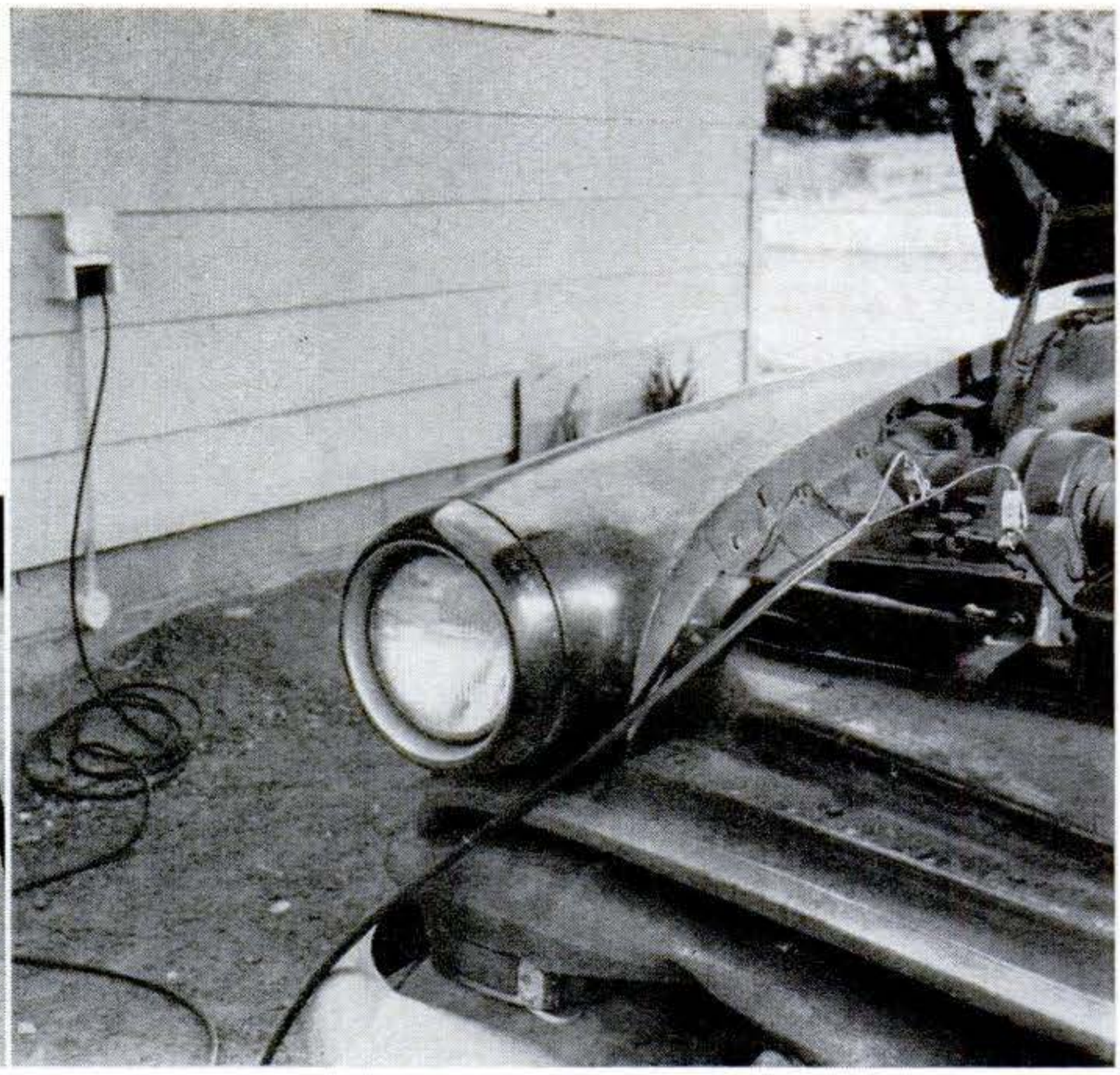
How Two Motorists Boost Their Batteries



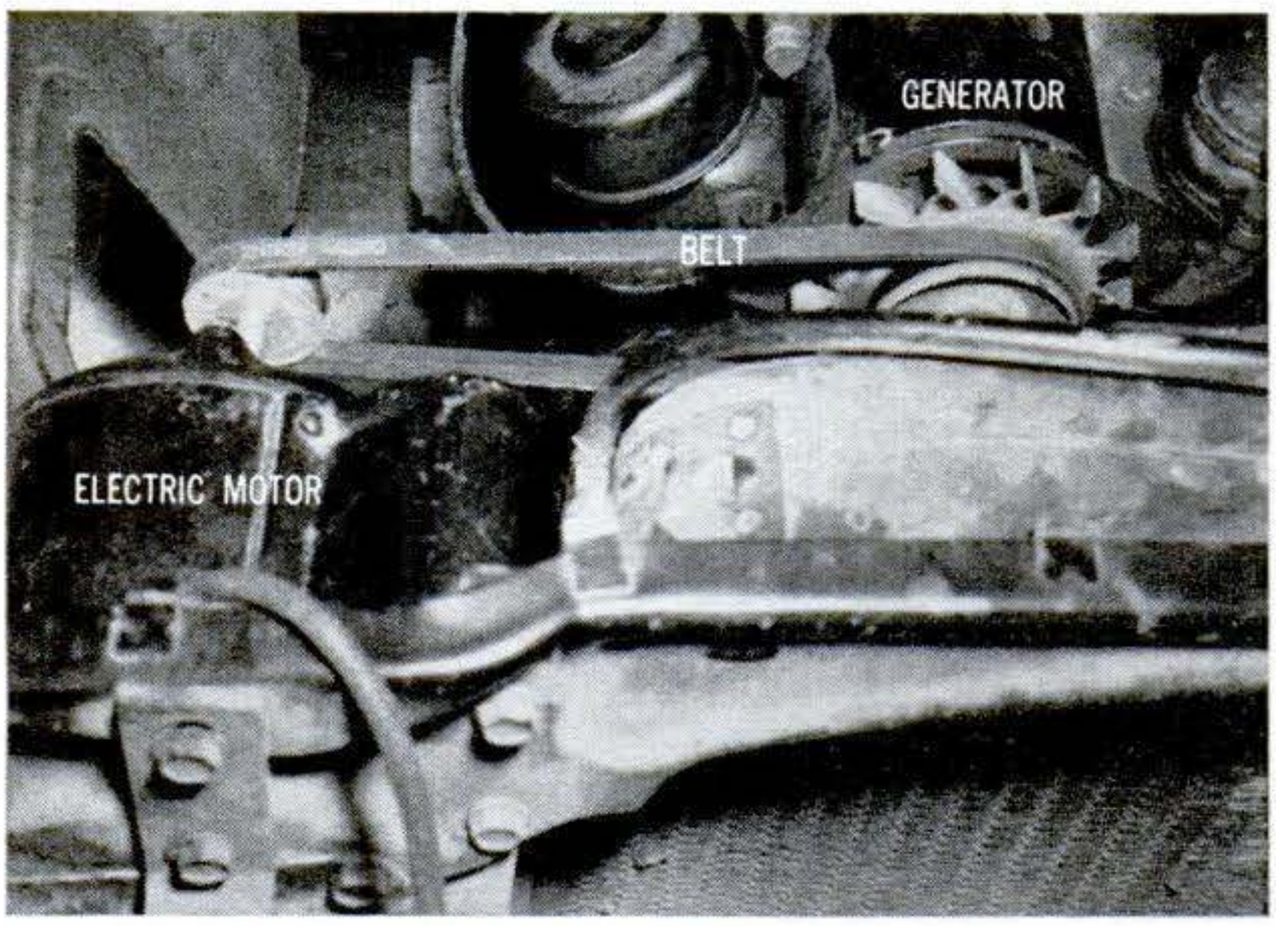


SMALL BATTERY CHARGER is out of the weather. Mounted in the basement, it is connected to a polarized outlet outside the home of Clarence Leino. He parks his car in the open driveway and hooks up an extension between the car and the outlet box for an all-night charge.

A BATTERY that is half charged will start your car easily in mild weather, but it loses its punch when the mercury drops below freezing.

To be sure of peak winter capacity, Clarence Leino of New Berlin, Wis., rigged a plug-in charging outlet beside the open driveway where he parks his car. When he comes home from work each evening, he plugs in the extension wires, clamps on the battery terminals, and closes the hood. All through the night, a light trickle charge flows into the cells, filling them with energy for a fast getaway in the morning.

Besides the convenience of an easy hookup, the extension wire is safe to handle. It carries only 12 volts from a five-amp charger installed in the basement.



PERMANENTLY INSTALLED MOTOR drives the generator while Lee Phillips' car stands in the garage overnight. Car's voltage regulator adjusts the charging rate to the battery's needs, cuts out when it is fully charged.

Lacking a battery charger, but with a spare motor lying idle, Lee Phillips of Wyandotte, Mich., maintains a full charge by driving the car's generator with the motor. He permanently installed the motor on one side of the engine compartment of his '57 Pontiac. When he feels the battery needs a boost, he disconnects the fan belt and slips on another belt between the motor and generator. Plugged into a garage outlet, the 1,725-r.p.m. motor drives the generator fast enough to put out 15 amps. When the battery comes up to full charge, the voltage regulator cuts out the generator.

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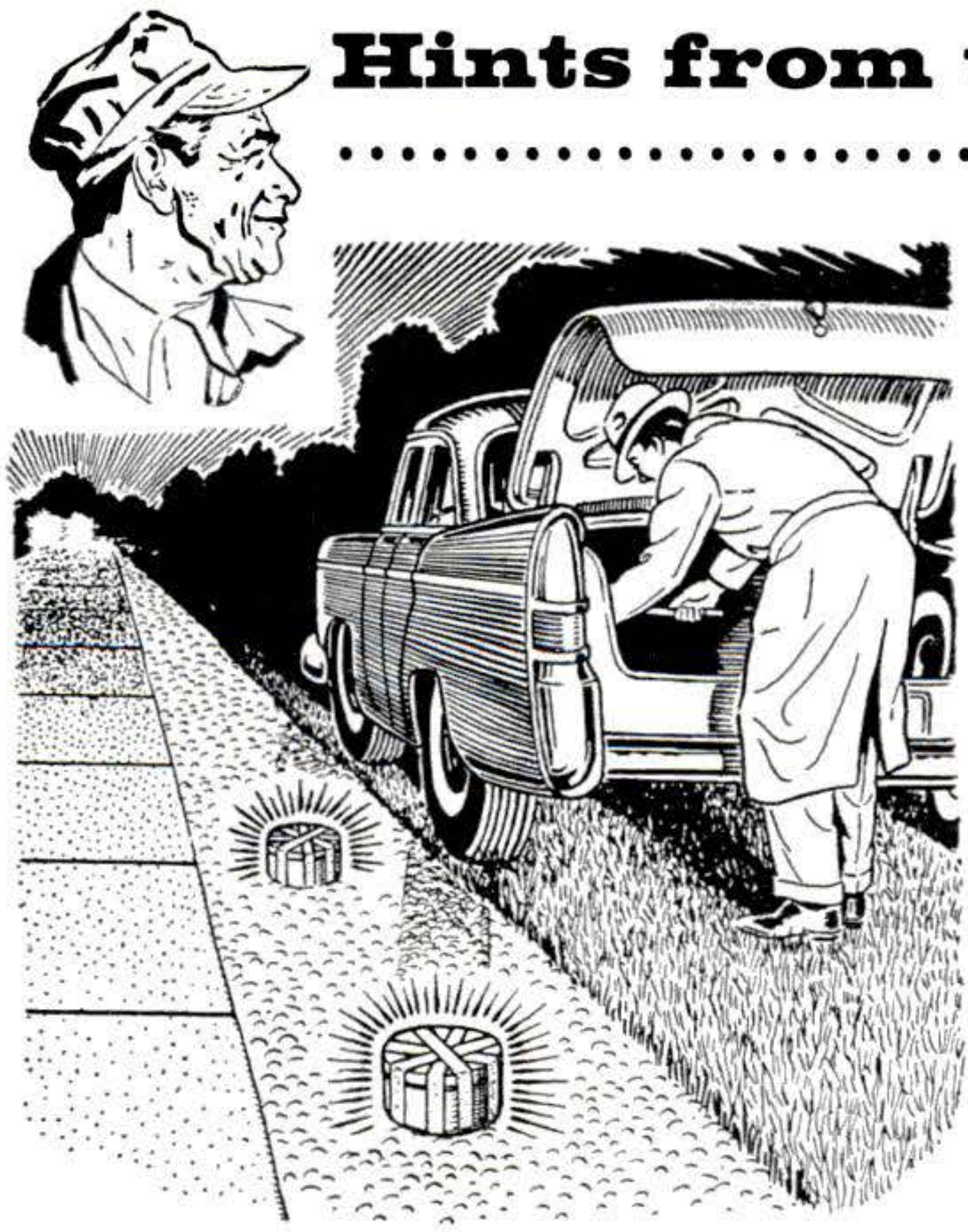
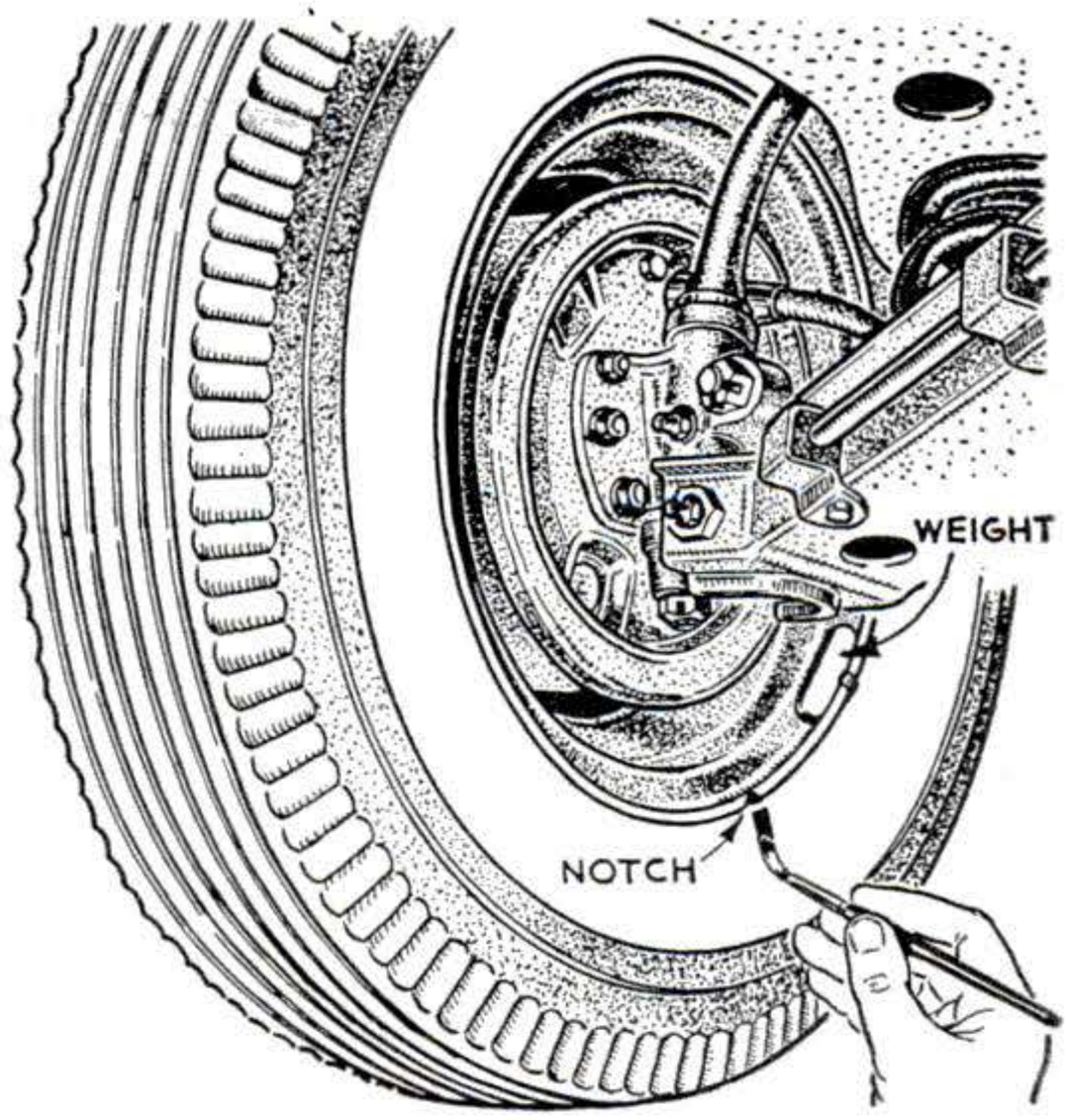
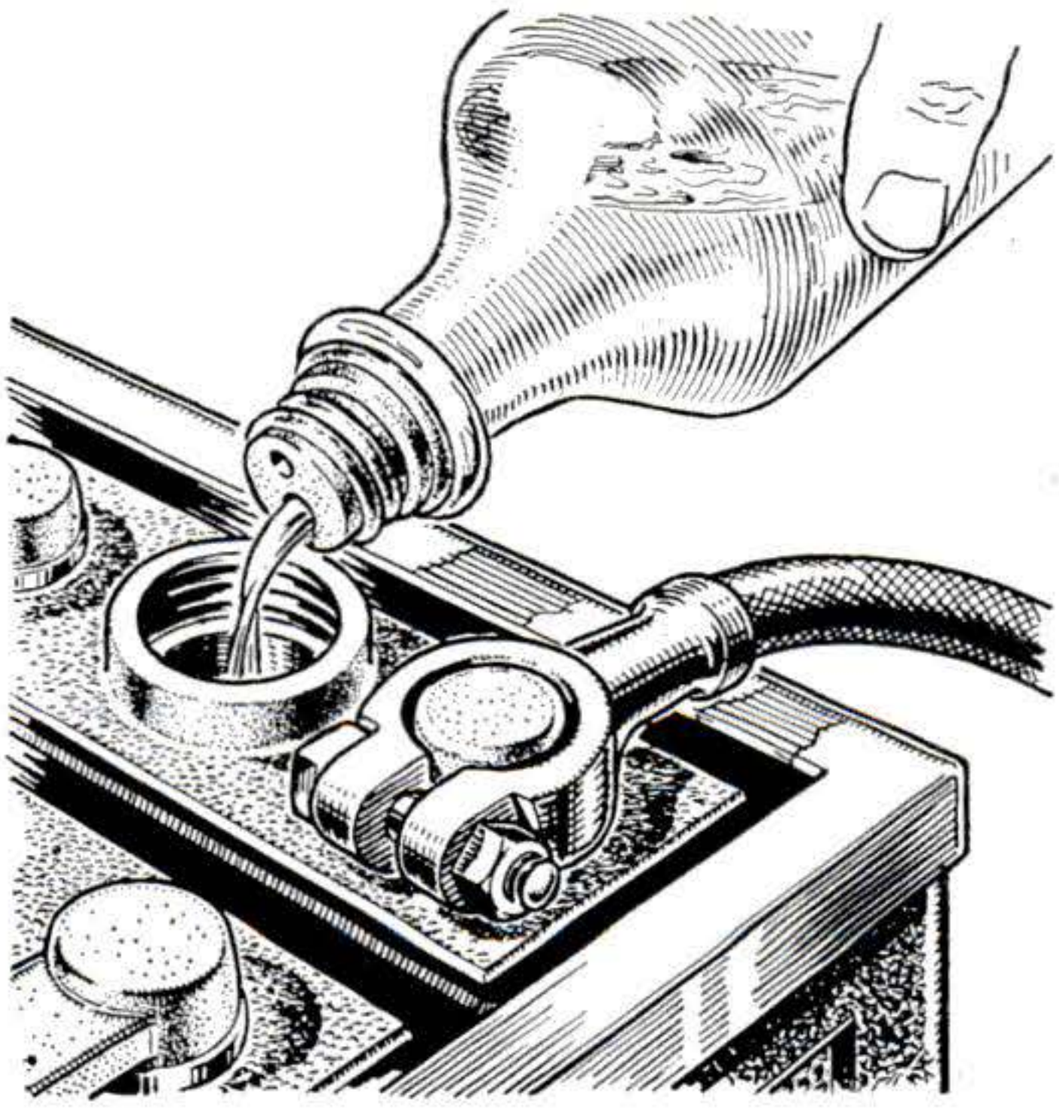
Hints from the Model Garage



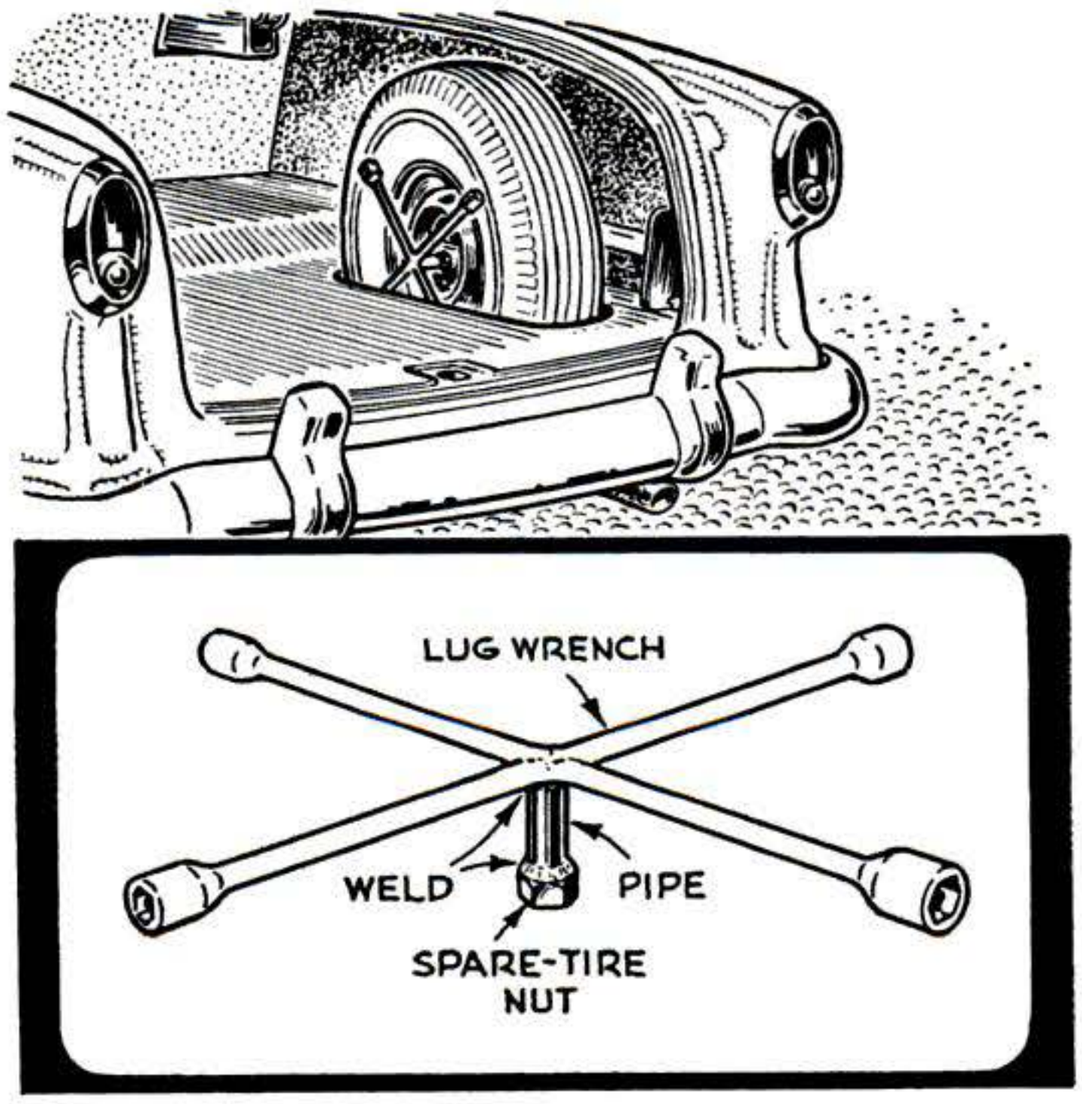
Warning markers for roadside repairs at night can be made from coffee cans. Fill them with sand and wrap reflector tape up the sides and across the lid. They're easy to cart in the trunk, handy to set out on any road shoulder in an emergency.



A balanced wheel should have its tire replaced in the same position—relative to the rim—as at the time of balancing. To assure this alignment, file a notch on the weighted rim and paint a corresponding spot or line on the inner sidewall.



Nursing a parched battery is a cinch if you put the distilled water in an empty pint- or quart-size ink bottle. The nonspill dispensing cap (designed for filling inkwells) lets you pour without waste just the amount your battery needs.



A missing lug wrench is an impossibility if you weld the tool to the retaining nut on your spare-tire stud. Measure outward from the nut to the plane of the tire sidewall; cut a spacer of that length from pipe with an i. d. larger than the stud.

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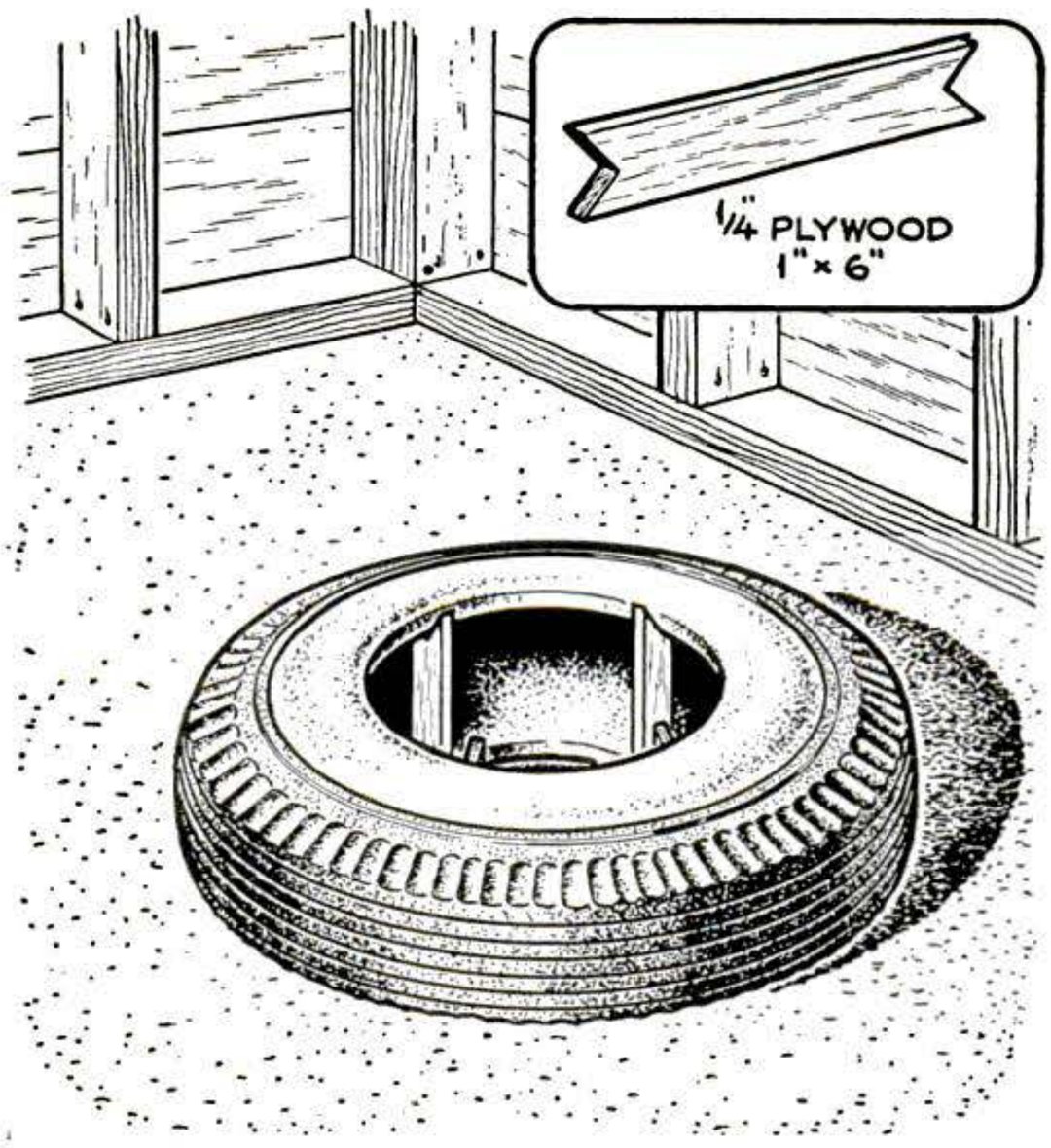
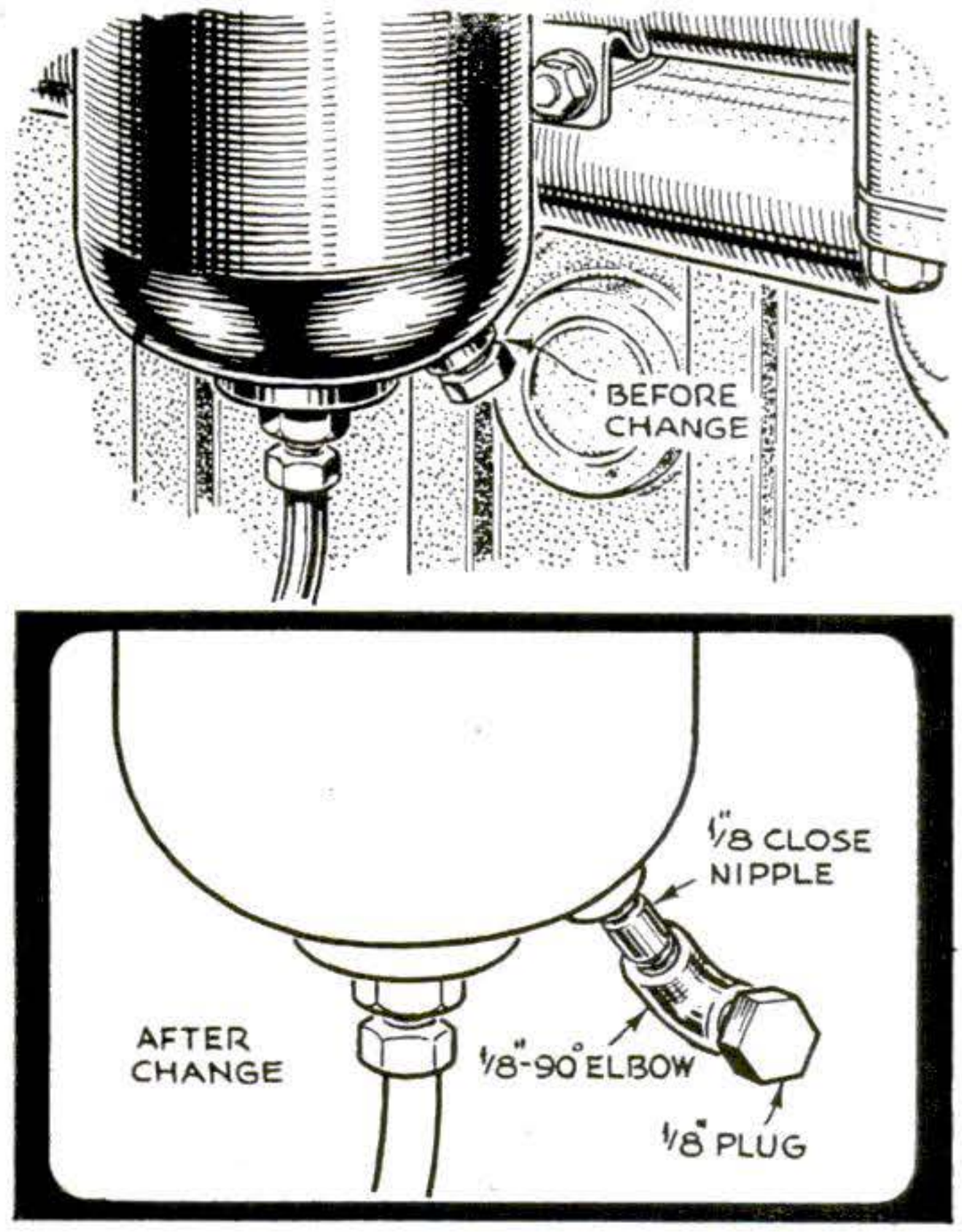
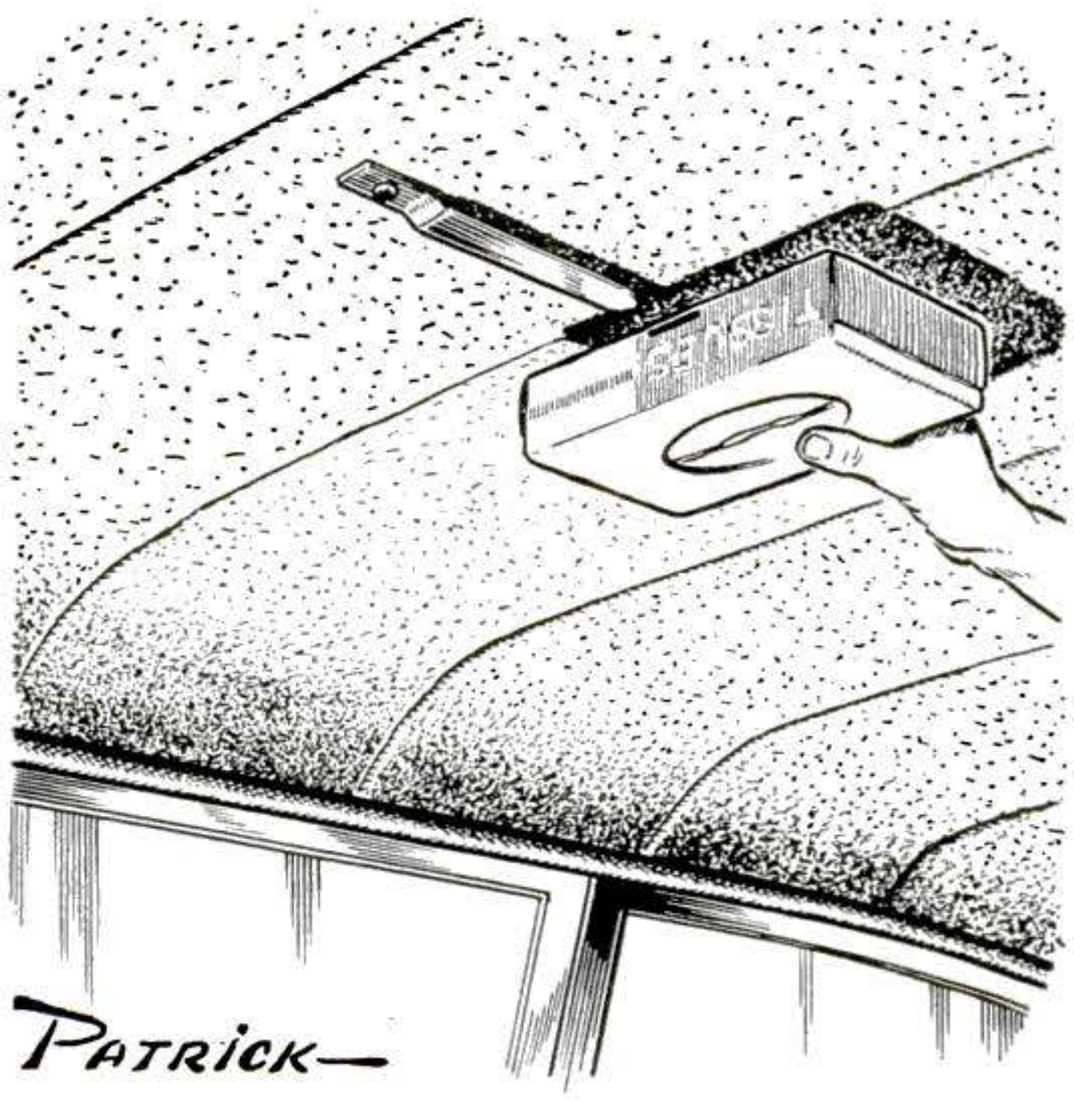
More Hints from the Model Garage



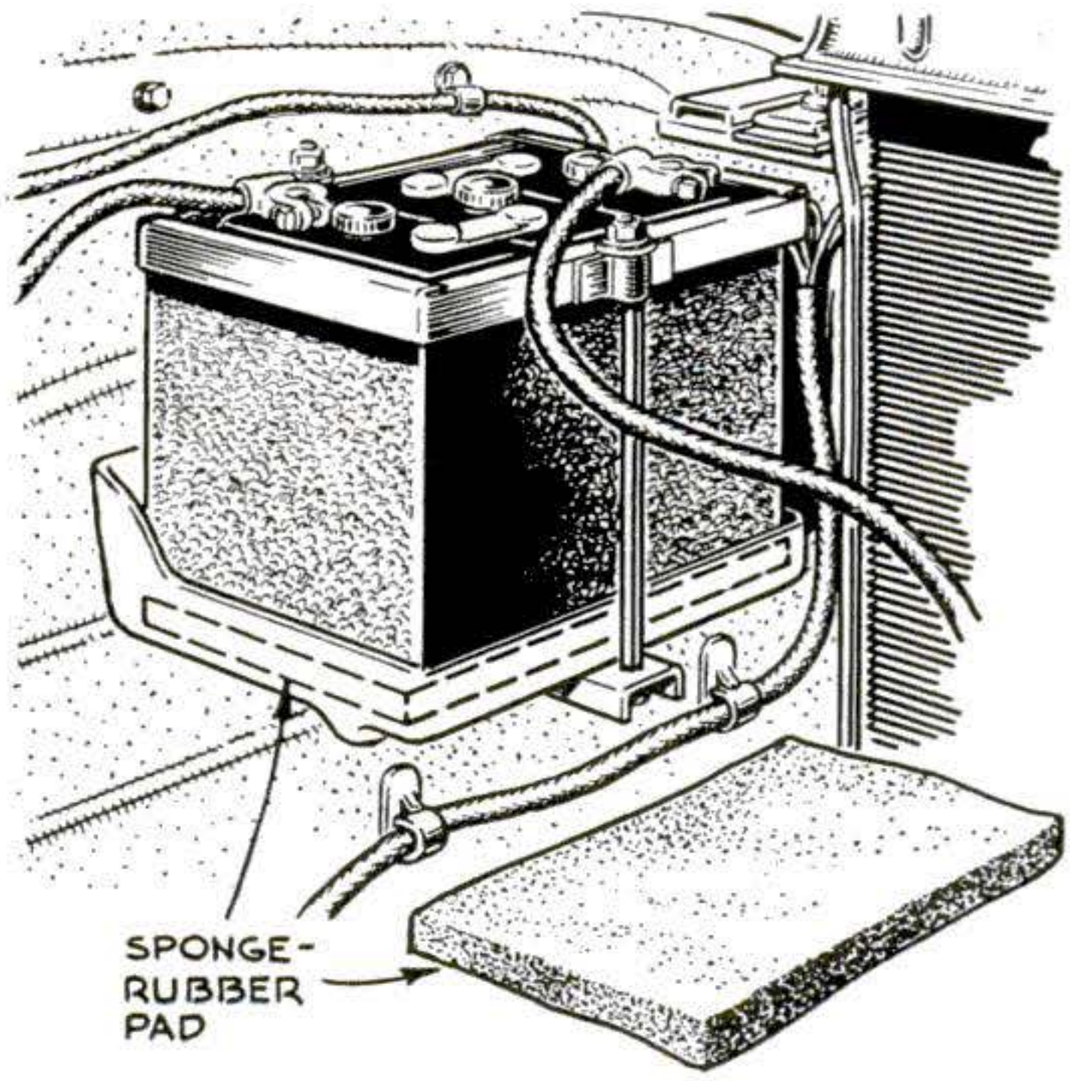
Mounting a new tubeless tire can be difficult when the wrappings have pressed the beads too close together to permit inflation. Let the tire stretch 10 or 15 minutes while the beads are held apart with notched spreaders of the size shown.



Oil-filter holders often have a small drain plug at the bottom of the case. Usually it's located so far down that it's hard to remove. To make the drain more accessible, attach a close nipple and elbow. Standard 1/8" fittings should work.



Lift your tissue dispenser—take it out of the glove compartment and put it where both seats have access to it. Fasten one end of a spring to the car ceiling and round the other to slip through slits at the base of the box.



A pad of sponge rubber, 1/4" thick, will pay dividends if placed in the tray of the battery holder before you install a new battery. It will lengthen the life of the battery by cushioning its ride, and will protect the tray from acid spills.

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ROCHESTER CARBURETORS

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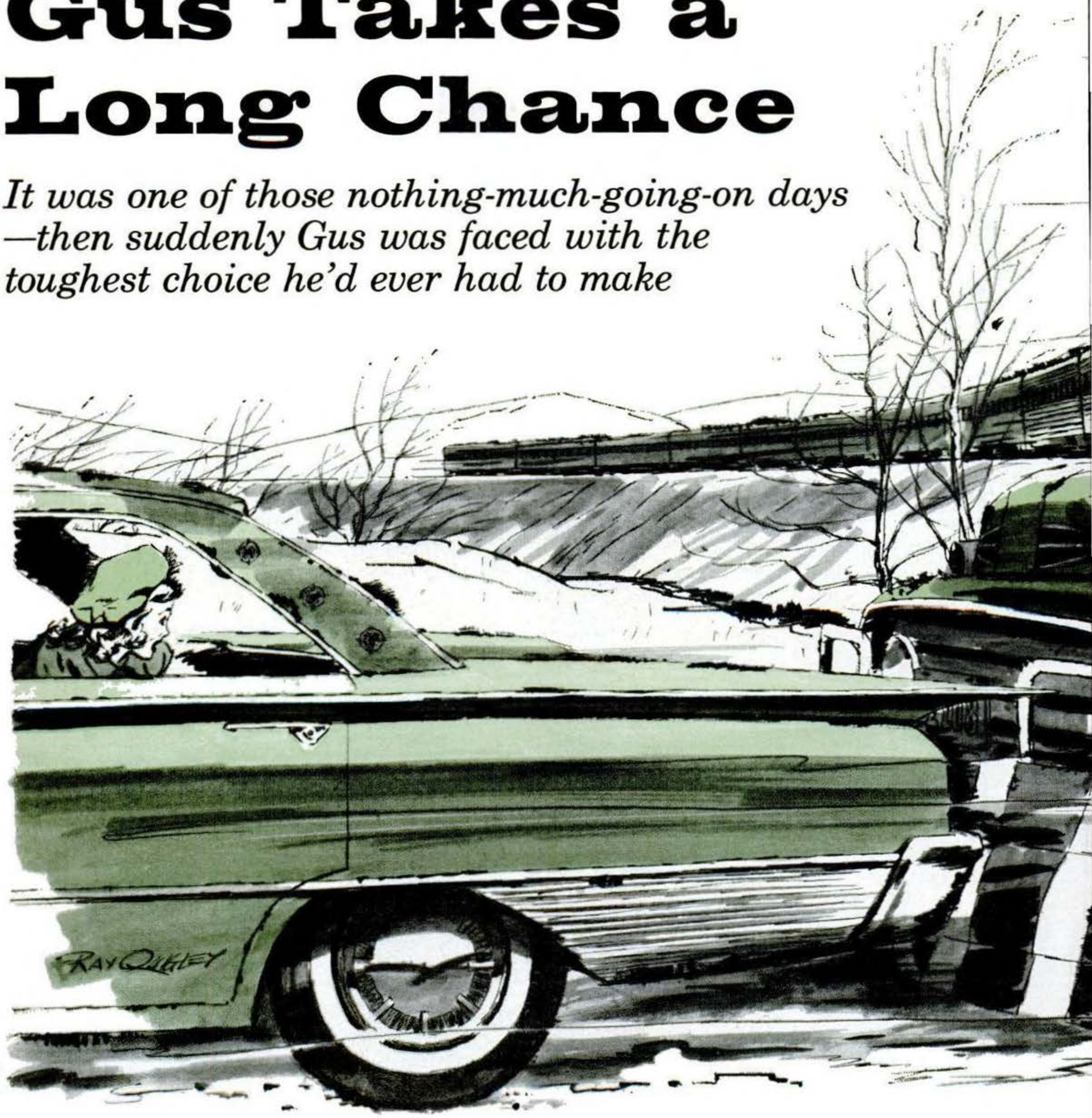
Gus Takes a Long Chance

It was one of those nothing-much-going-on days —then suddenly Gus was faced with the toughest choice he'd ever had to make



By Martin Bunn

ONE eye on the clock, Stan hung up the inspection lamp, picked up a lubricant spray, and headed back under the small English sedan on the grease rack.

"Hold it a minute, Stan," said Gus, emerging from the office where he had taken a phone call. "What did I tell you about using this rack?"

Stan flushed under the grease smudges. "Guess I did forget to put down that safety prop. But, Gus—it's only a light car."

"Nothing light about twenty-one hundred pounds if it falls on you. Sure, the risk of the hoist valve bleeding off is small. But why take any chance you don't have to?"

"Guess I tried to rush it. Mrs. Dolan wants her car at noon." Carefully Stan set the prop in place.

"Complained of squeaks, did she?"

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As the car moved, an air whistle screeched. In a split second a diesel locomotive was bearing down.

"Yes, but nothing's loose," said Stan. "Shock absorbers aren't leaking. Chances are it's the spring leaves, so I'll spray on some oil."

"Mm. Before you take *that* chance, Stan, do me a favor."

"Sure, Gus. What?"

"Read the car manual. I left it on the seat, hoping you would." With that, Gus walked out to where his wrecker was parked, whistling innocently.

Smiling at the remembered expression on Stan's face, Gus wheeled the wrecker over a county road, a short cut to the point on the turnpike from which the call had come. There he found a stalled motorist. A new fan belt soon put the disabled car back on the road.

The job done, Gus left the turnpike and headed back over the same winding road. Sun sparkled on gritty paving, the wrecker's motor purred competently, and Gus found time to wonder whether Stan had got the message about Mrs. Dolan's

CONTINUED

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car. Chances were—Gus smiled as the thought phrased itself in his mind—that Stan had.

THERE wasn't a hint, on that sun-drenched country road, that Gus would soon be taking a long and deadly chance of his own choosing.

The first innocent clue to it was an almost-new sedan ahead. As the wrecker crept up on it, Gus eased off the throttle. The other car was doing scarcely 30, and Gus fancied he heard a skip in the engine now and then. A double line forbade passing, so Gus stayed back.

As the road began to climb, the new car barely maintained speed. At the crest, just below a railroad crossing, Gus heard the other driver shift down. But the car lurched onto the track only to buck to an abrupt stop.

At that moment the crossing blinker began to flash its red-eyed warning. Simultaneously the other car's starter began to grind. As it kept on, Gus realized two things: The other driver could see neither blinker; and with the starter groaning, he probably couldn't hear the warning bell.

But as he shut off the starter, the clang reached him. The man behind the wheel put his head out, then renewed his efforts to start the dead engine.

"Why doesn't he jump?" thought Gus.

The car's starter ground desperately. Even as Gus was about to get out and shout his warning, he saw something that impelled him to act. A child's face rose into sight at the rear window.

Quickly shifting into low gear, Gus approached the car as fast as he dared and nudged none too gently into the bumper. The child rose higher in surprise, and Gus saw that it was a girl.

As the other car moved, an air whistle screeched offside, and in a split-second glance Gus saw a diesel locomotive bearing down, its cab looming in the wrecker's window. He felt his wheels bump over the tracks, saw the car lurch safely past the far blinker, and felt a shock of air as the train blasted by, inches behind the wrecker.

The car ahead rolled to the side of the road and stopped. Its driver got out shakily as Gus pulled alongside. A slender, sandy-haired, well-dressed man in his late forties, he evidently found it hard to speak.

"That was—we—thank you!" he blurted. "Knew it was time to jump—but we couldn't."

"You cut it too fine!" exclaimed Gus, but fell silent as the driver opened a rear door. The dark-haired little girl in back wore leg braces.

"She can have them off soon," her father explained. "We're headed for the doctor now. But she still can't move quickly. I—I don't think we'd have made it, except for you."

Gus mopped his damp face. "Bad time for a car to act up."

The man shook his head. "No, it was my fault. I knew it was time for new points again. Please tow us in and install them."

AS GUS rolled into the Model Garage with the car, Stan waved and called. "Thanks for the tip, Gus."

"What tip?"

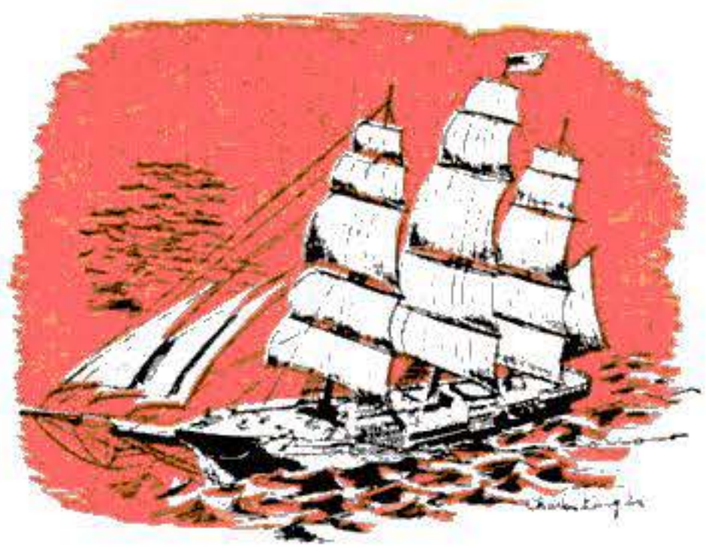
"About not taking a chance on that squeak job. This car has rubber spring bushes. The manual said to paint the bushes with brake fluid. I used rubber lube. No more squeaks."

"Fine. While I eat lunch, you might check this car for hard starting."

When he returned, he found Stan replacing the distributor cap.

"It's a wonder he got out on the road. Points were the worst burnt I ever saw." Stan touched the starter. The engine caught at once. "See? New points. Got a real hot spark now."

Where'd it come from?



KNOT: The nautical mile got its name because once it really was a knot—one of many at 47-foot intervals along a "log line." When the log end was thrown overboard, a sailor would count the number of knots unreeled within 28 seconds. Because knot spacings were in the same ratio to a mile as 28 seconds to an hour, their exact count gave the ship's speed.

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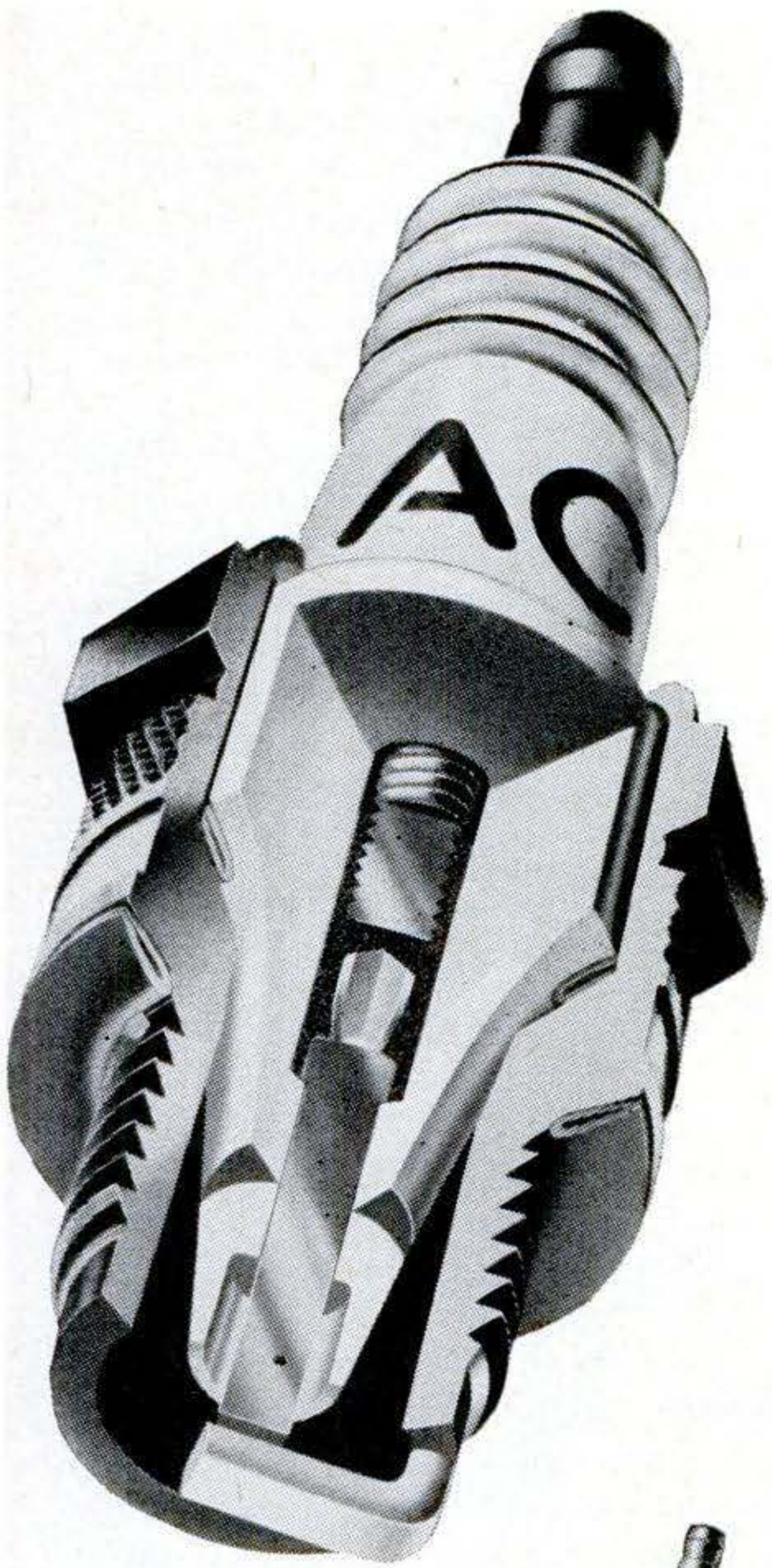
Exclusive Copper-Glass Seal Stays Gas-Tight Under 1400 Pounds Pressure



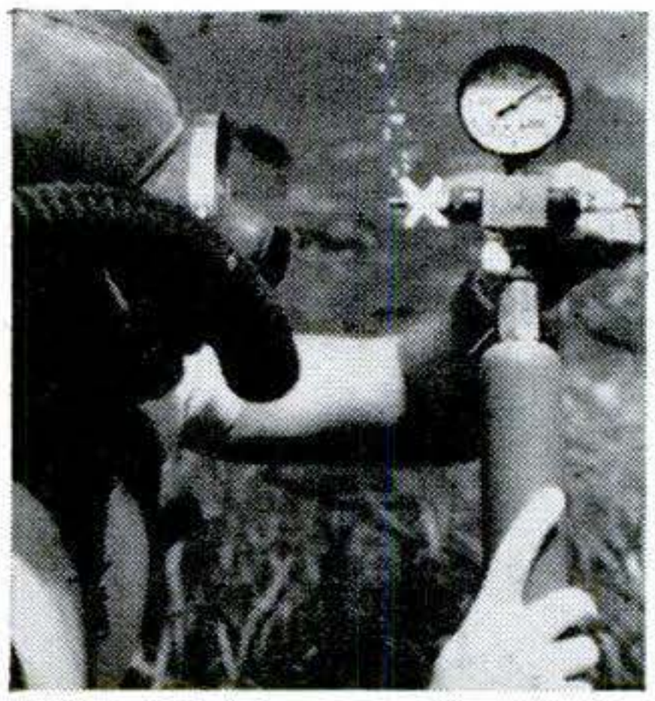
AC Fire-Ring Spark Plugs are your best buy in spark plugs for many reasons—but a big one is AC's exclusive Conductaseal that bonds the terminal screw and center electrode to the aluminum oxide insulator. This seal protects against leakage far better than ordinary seals. Leakage alters the spark plug heat range, which can damage the spark plug and, in turn, the engine.

Conductaseal is a product of AC research. It is made of finely ground copper and glass, inserted into the center of the insulator and formed under terrific heat and pressure into an unyielding bond. It is tested under 1400 p.s.i. to give you trouble-free spark plug operation and long life.

The pictures on this page give graphic proof of Conductaseal superiority. Remember them the next time you buy spark plugs. For highest quality and greatest reliability, ask for AC Fire-Ring Spark Plugs.

AC SPARK PLUG THE ELECTRONICS DIVISION OF GENERAL MOTORS

AC PRESENTS THE ART CARNEY SHOW, NBC-TV, FEB. 5



Skin-diver demonstrates how AC Conductaseal stays gas-tight under 1400 p.s.i., while ordinary spark plug leaks.

This X-ray check makes certain that the Conductaseal has bonded properly. It's one of 116 AC reliability tests.

Every AC Spark Plug features the exclusive Hot Tip that heats faster, cools faster to stay clean longer.

They must be the best!

AC Fire-Ring Spark Plugs

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"Okay, Stan. Make out the bill. Half price on the tow."

"Half? But it was a road call—"

"Special case," snapped Gus, and escaped into the office. For an hour he made out bills, with an uneasy sense of having forgotten something. Finally he put his head out.

"Stan! Call me when the owner of that hard starter shows up."

"He's here now," said Stan in a curiously awed tone, and Gus saw that the stranger and the girl, whom he had dropped off at the doctor's door, were in the shop. Gus went over.

"I'm Ralph Emerson," said the stranger, "and this is Susan. It seems the whole town knows you, Mr. Wilson."

"It's a small town," answered Gus. "Now I remember! Did you say it was time *again* for new points?"

Emerson nodded. "Sixth time since I've had this car. It burns them up in two weeks. Nobody knows why."

"The condenser's okay," volunteered Stan. "I checked it out."

"Everything's okay," agreed Emerson. "But the points always burn."

"How about the coil?" asked Gus.

"One man put in a new one a month ago. He thought the factory had installed a six-volt coil by mistake. But it made no difference."

"Did you buy the car new?"

"Yes, at a bargain. Then I heard why. The dealer had bought a number of new cars from an out-of-state agency in a flooded area. He hauled the cars here, installed new wiring and sold them at a discount."

The wiring did look new, with no sign of water damage. Gus scrutinized the thin primary wires connected to the coil as if counting threads in the insulation. Disconnecting one, he hooked an ammeter into the line and turned on the ignition briefly.

"I think we've got it," said Gus. "Stan, get me an ignition parts list for this car."

Studying the sheet, Gus checked one item on it. Stan scurried off again.

"More trouble?" asked Emerson.

"The end of your trouble, I think," said Gus. "You won't need new points for a long time."

As Stan did the job, Gus motioned the customer and his daughter to chairs and began filling his pipe. "Actually, your dealer was conscientious. But he made a mistake."

"How so, Mr. Wilson?"

"Most ignition systems have a resistor in the primary circuit to hold current to a safe limit on starting and idling, when everything is cold and resistance low. Now some 1960 cars have a resistor *wire* instead. The mechanic who rewired yours didn't know that. He ripped it out and put in ordinary wire."

"But the car ran well at first."

"Sure. The coil drew too much current, but gave a good hot spark—until that extra juice burned the points."

Emerson stood up. "I owe you more than I can ever repay, Mr. Wilson. If I can ever do anything for you, please give me the chance to do so."

"TALK about big shots," murmured Stan as the car pulled out.

"Who? Mr. Emerson?"

"Sure, he's the Supreme Court judge on those racket trials in the county seat. And *he* wants to do something for *you*."

"I don't remember breaking any laws lately," laughed Gus. "And anyway, I got this job without influence. In fact, it was more a case of push than pull."

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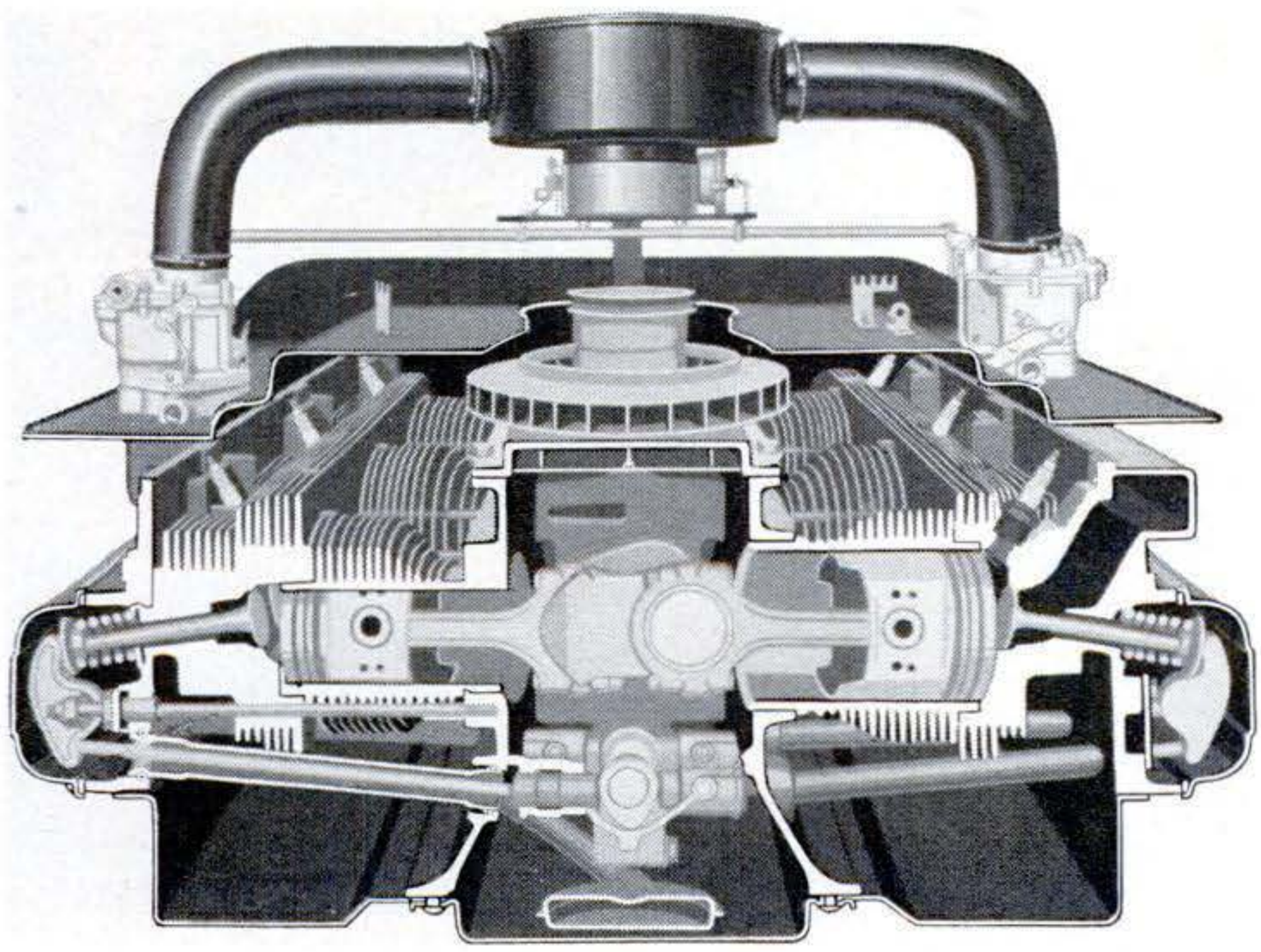
CORVAIR'S A NEW SMOOTHIE

Behind Corvair's array of engineering innovations (*literally behind*) lies its engine: America's first and only rear-mounted air-cooled aluminum "pancake" six. The spec sheet reads like this: 140 cubic inches of displacement, bore 3.375 inches, stroke 2.60 inches, maximum horsepower 80 @ 4400 r.p.m., maximum torque 125 ft.-lb. @ 2400 r.p.m. (Hitch these figures to a car weighing only 2,375 pounds at the curb and you've got yourself a peppery package, if we do say so.)

Anyway, of the four adjectives, we particularly like "pancake." Translated, it means that this is a horizontally opposed six, instead of the conventional in-line type. If you cut the engine crosswise, it would look like the picture.

There are three pairs of cylinders, of course, each working in unison. When one piston is at the top of its stroke, so is its mate. So? Well, Barney Navarro, who's engineering editor of Motor Life magazine and should know about these things, writes "opposed engines (of Corvair's design) are inherently balanced." In other words, each pair of pistons, rods and crank throws balance each other, and there's no need for counterweights. Because this type of engine is inherently balanced, it's inherently smoother than an in-line six. And after all, ultra-smoothness is just what you're after.



As you might suspect, there's precious little of the commonplace in a Corvair engine. Yet there's nothing so radical that it hasn't been proved time and again for reliability. About the only question left now is whether we can build enough of these cuties to fill the demand. One thing you ought to do for sure is to try one out. After that, you'll probably be badgering us to build *you* one. This is a problem we're happy to have. . . . Chevrolet Division of General Motors, Detroit 2, Michigan.

That rear engine is just one of the engineering marvels in this new Corvair. Others include the silken smoothness of independent suspension at all 4 wheels . . . a practically flat floor, front and rear . . . briskly competent handling . . . and the ingenious unit combining the engine, transmission and rear axles. Be prepared to spend some time with these wonders when you check out the revolutionary Corvair at your dealer's.

corvair
BY CHEVROLET

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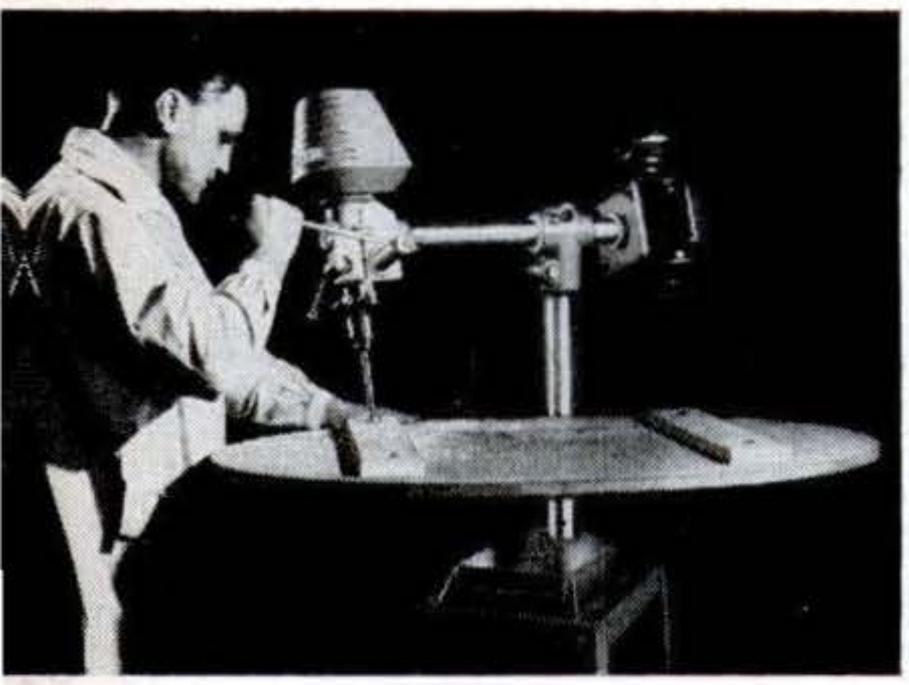
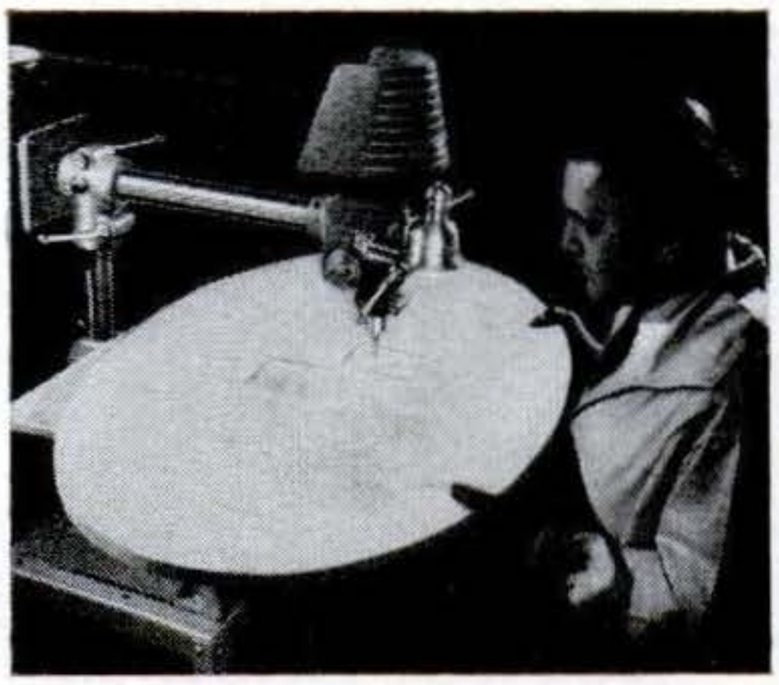
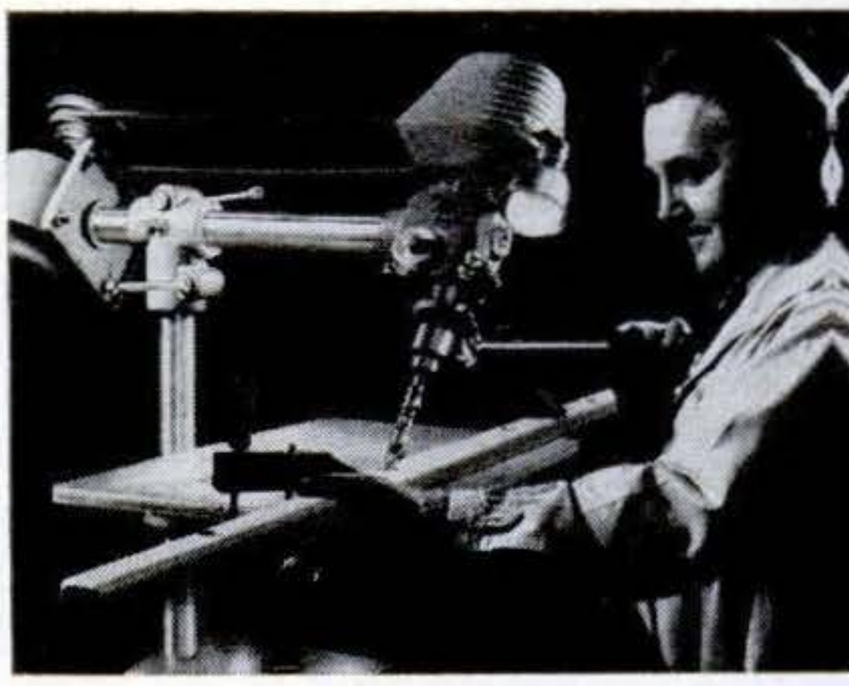
You can do more with DELTA



Angular drilling for the splayed legs on a coffee table is no problem with this tool because the angle of right or left tilt can be set by a calibrated scale and locked into position. Resetting head to vertical position is simplified by setting of the automatic stop into a milled groove.



Inlay routing in the center of a 30″ x 40″ project is possible because there is 16⅜″ capacity between the column and the router bit. Use of the fastest of the four speeds available makes this a smooth operation. Controls are conveniently grouped "up front" for safe, positive action.



Spindle drilling on an extra long hand rail *does not* require a special fixture or jig because the head tilts. Big ¾″ x 23¾″ x 15⅞″ table gives adequate support while remaining parallel to the base. Laminated wood work surface is mounted to a fully machined 8½″ x 9″ cast iron table.

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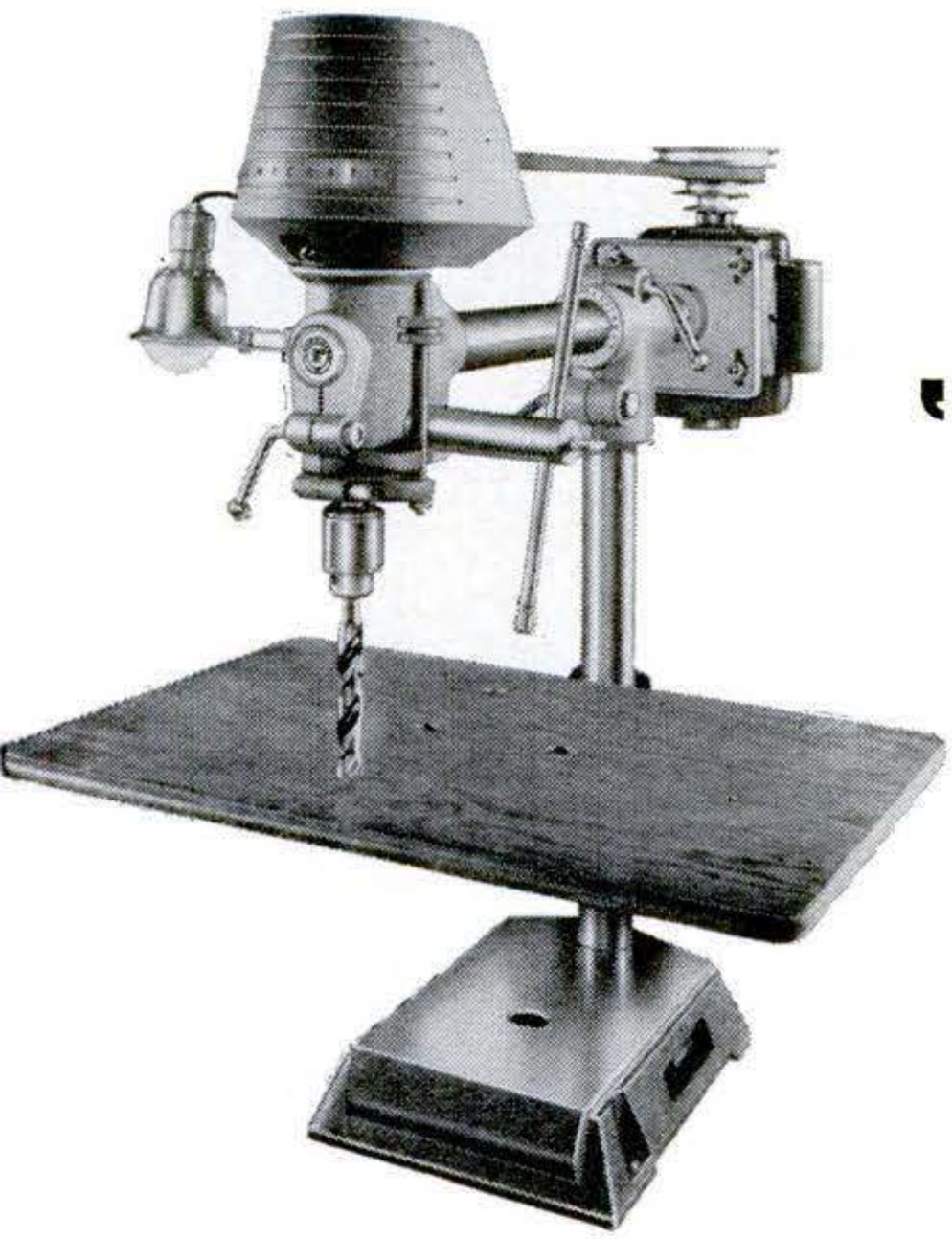
New radial drill press



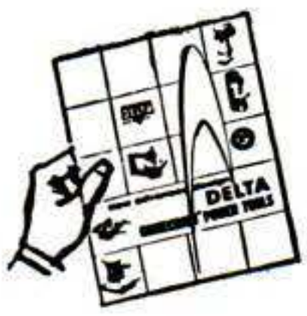
makes "impossible" drilling easy

DELTA 32″ RADIAL DRILL—basic machine complete with ½″ capacity geared chuck, belt and motor pulley.
Weight 85 lbs—only **$89.50** (slightly higher in the West).

Here's just what you'd expect from Delta—a brand new radial drill—specifically designed to handle drilling jobs you *can't* do on a conventional drill press. There is almost no limit to the flexibility this tool puts at your fingertips—and you'll really appreciate the big capacity. The head swivels 360° around the column, tilts more than 90° left and right, travels almost a foot forward and back—yet the work always remains parallel with the base. You can drill to the center of a 32″ circle, rout, sand, mortise, do dozens of operations at your choice of four speeds (700,1250,2400,4700 r.p.m.) on a wide variety of materials.

You can count on this tool to extend your skill, broaden your range of projects. And because you know tools, you know you can count on the precision, ruggedness and safety that Delta's 31 years of experience build into tools used throughout industry and in home workshops.

Consider the many ways you can do more jobs better, quicker and easier with the *newest* Delta tool—you'll want to see the Radial Drill in action! Visit your Delta Dealer (he's listed under "TOOLS" in the Yellow Pages) or your leading Department, Hardware or Building Supply Store. Do it soon!



See the world's most complete line of home workshop power tools and accessories—pictured and described in this colorful, FREE Homecraft catalog. Write to: Rockwell Manufacturing Company, Delta Power Tool Division, 504BN. Lexington Ave., Pittsburgh 8, Pa. In Canada: Rockwell Manufacturing Company of Canada, Ltd., Guelph, Ontario.

DELTA POWER TOOLS

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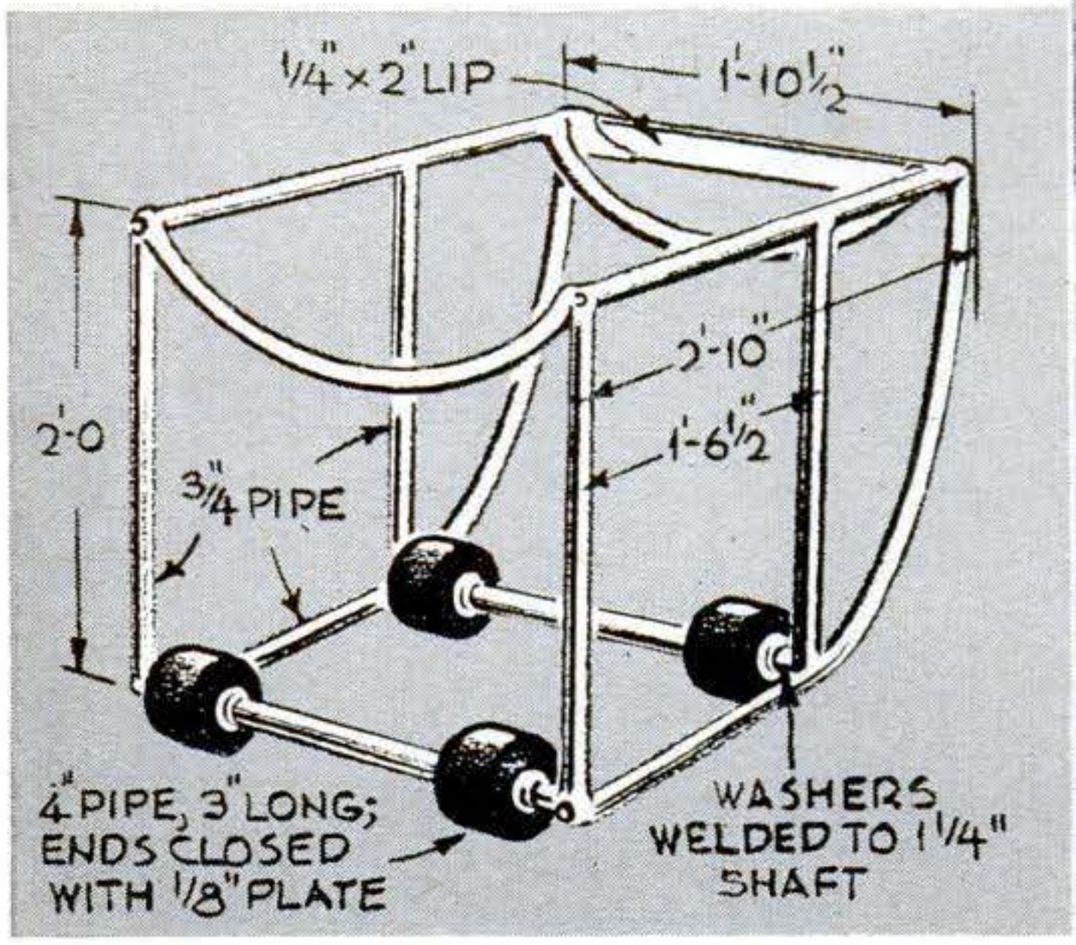
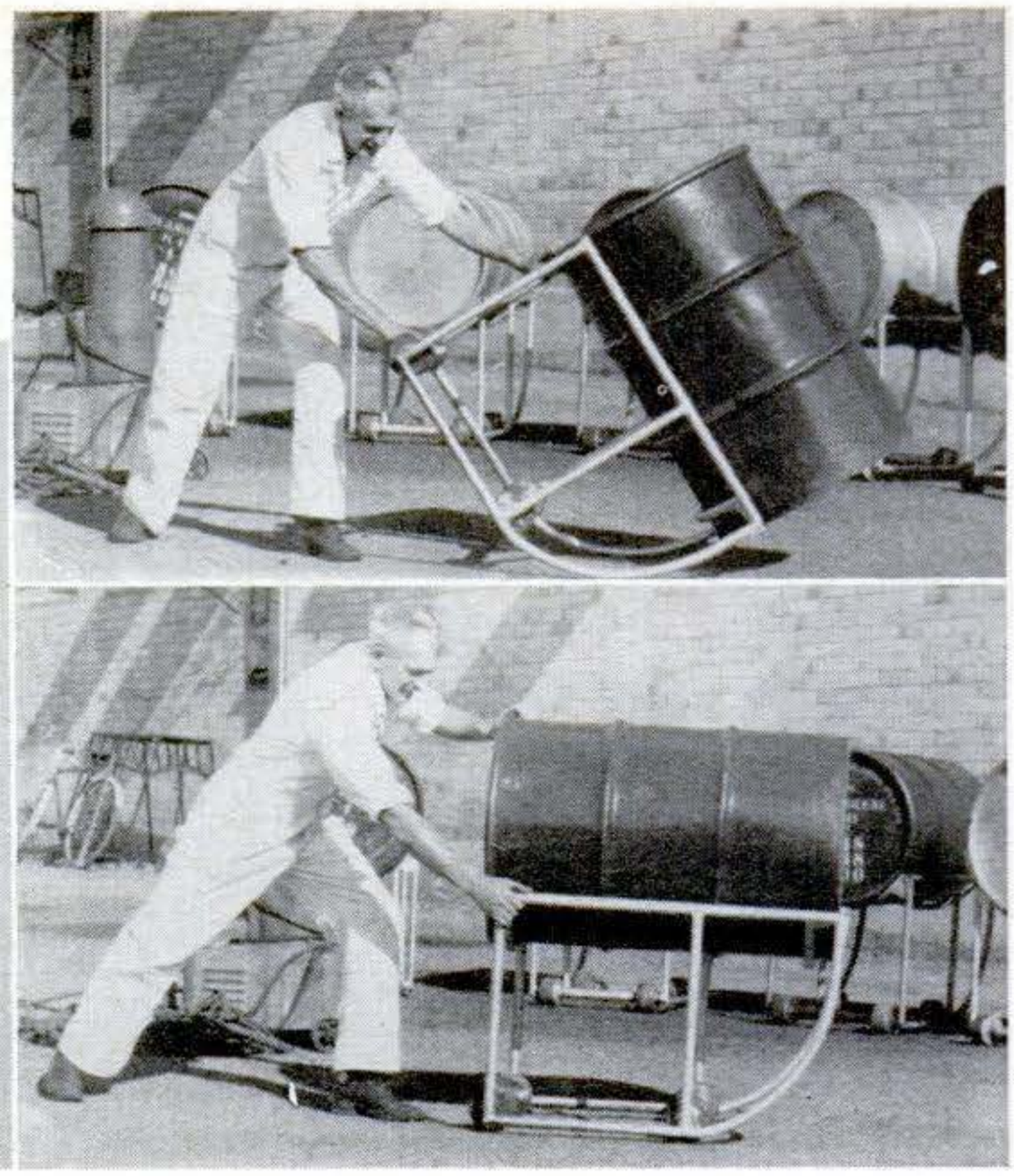
Short Cuts and Tips

FROM PS READERS

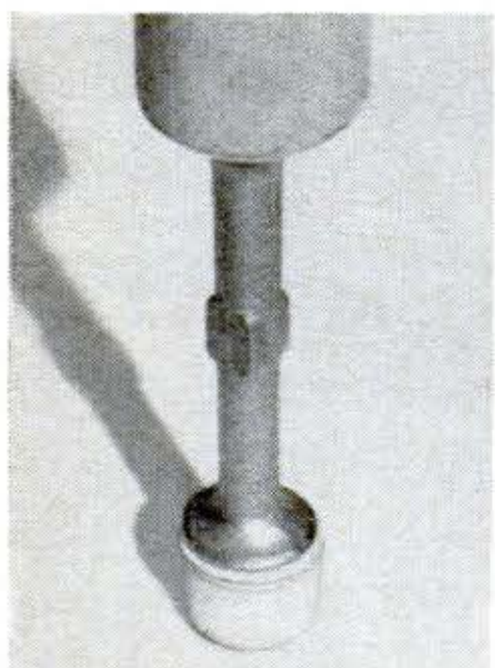




Rocking Trolley Lifts and Stores Drums

LIFTING filled drums to pouring racks was a problem at our bulk store. Now this loading trolley makes raising and moving the drums an easy one-man job. The trolley is rocked forward and its flat lip is hooked under the drum. Then rocking the trolley back on its wheels raises the drum to a convenient height for filling smaller containers.—*W. G. Richards, Grafton, N. S. W., Australia.*

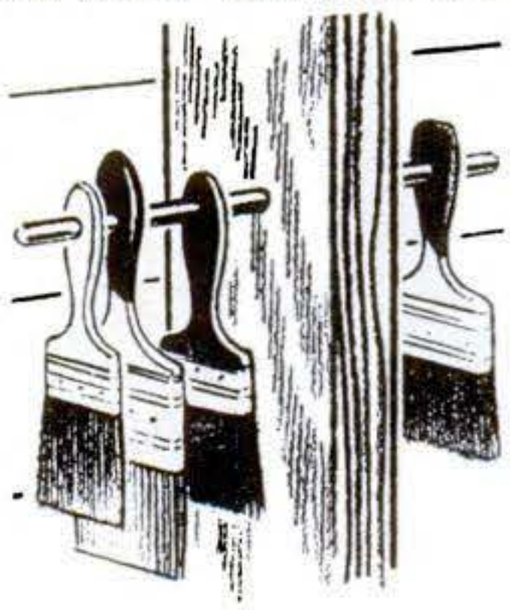
How to Raise a Table

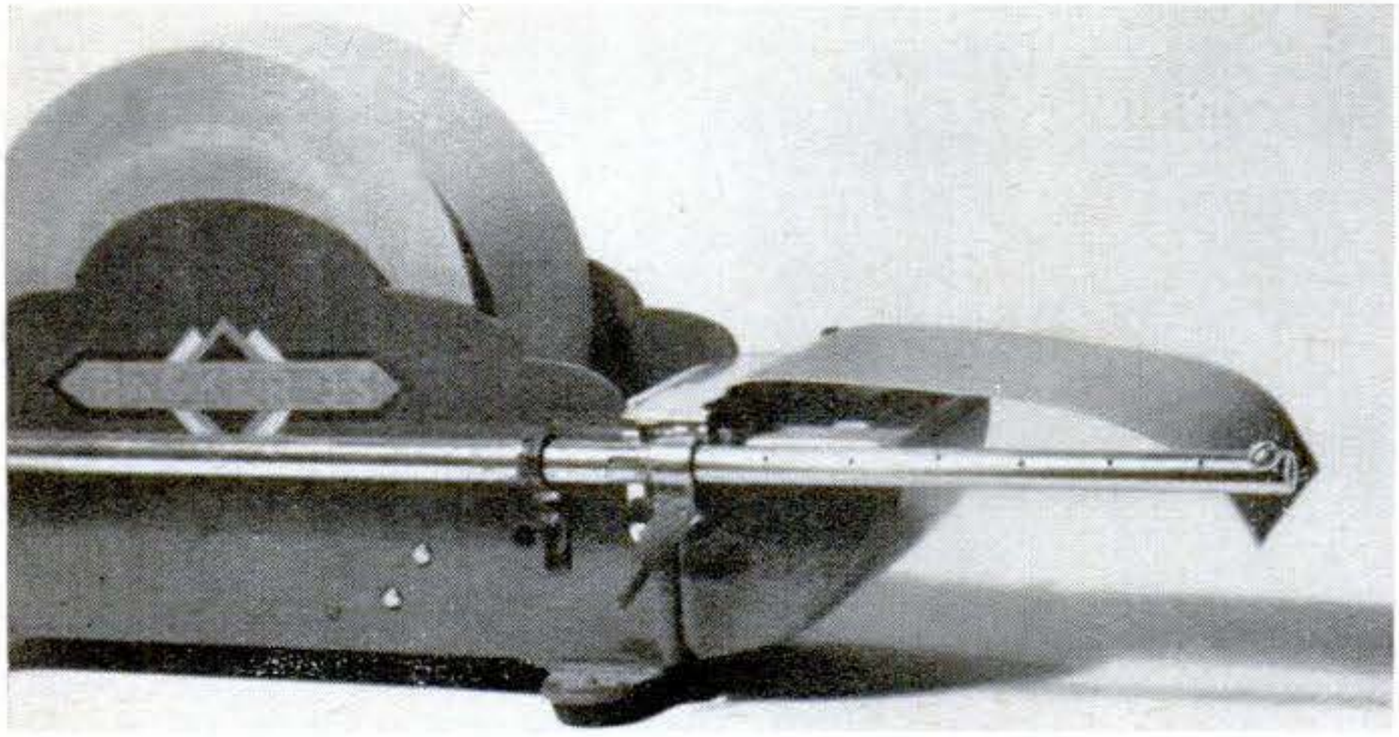


IF A card or chairside table is at an inconvenient height for eating or working, give it a lift. An easy way is to screw rubber-tipped doorstops into the legs. Drill pilot holes to keep the wood from splitting.—*Frank A. Javor, North Bergen, N. J.*

Neat Paintbrush Hanger

A SHORT length of 1/4" dowel makes a handy rack for storing your brushes between paintings. Drive the dowel through a hole drilled in a wall stud. Holes in the brush handles should be drilled a little larger than the dowel.—*G. E. Hendrickson, Argyle, Wis.*





Music Stand Gauges Tape

A MUSIC-RACK stand can simplify cutting uniform lengths of gummed tape. Clamp the outer telescoping tube to the side of a tape dispenser. The inner tube can be locked at any length indicated by holes drilled an inch apart. The gauge will measure up to 15".—*W. Williams, Culver, Ind.*

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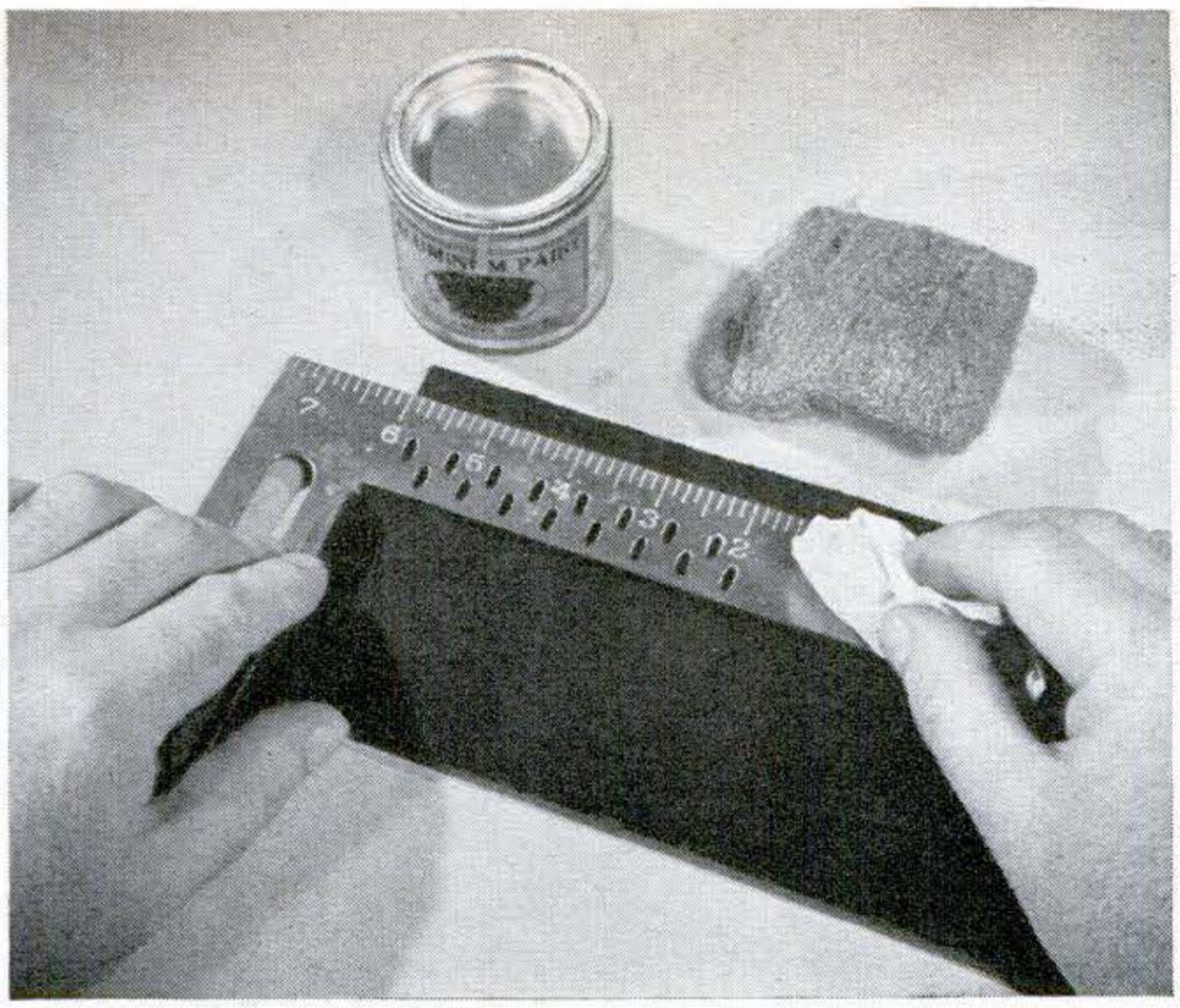
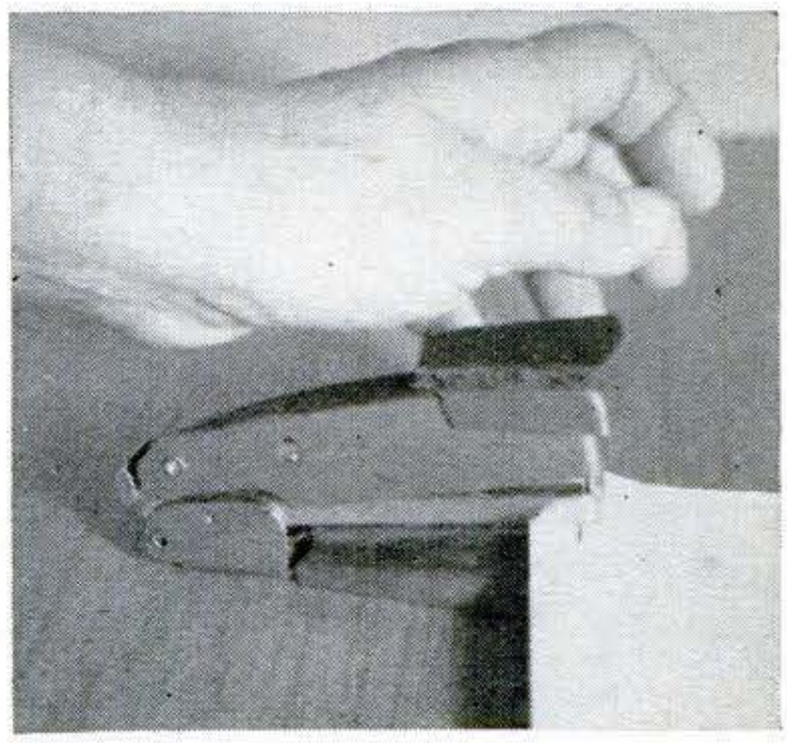
Short Cuts and Tips

FROM PS READERS



Renewing Lines and Numerals on Rule

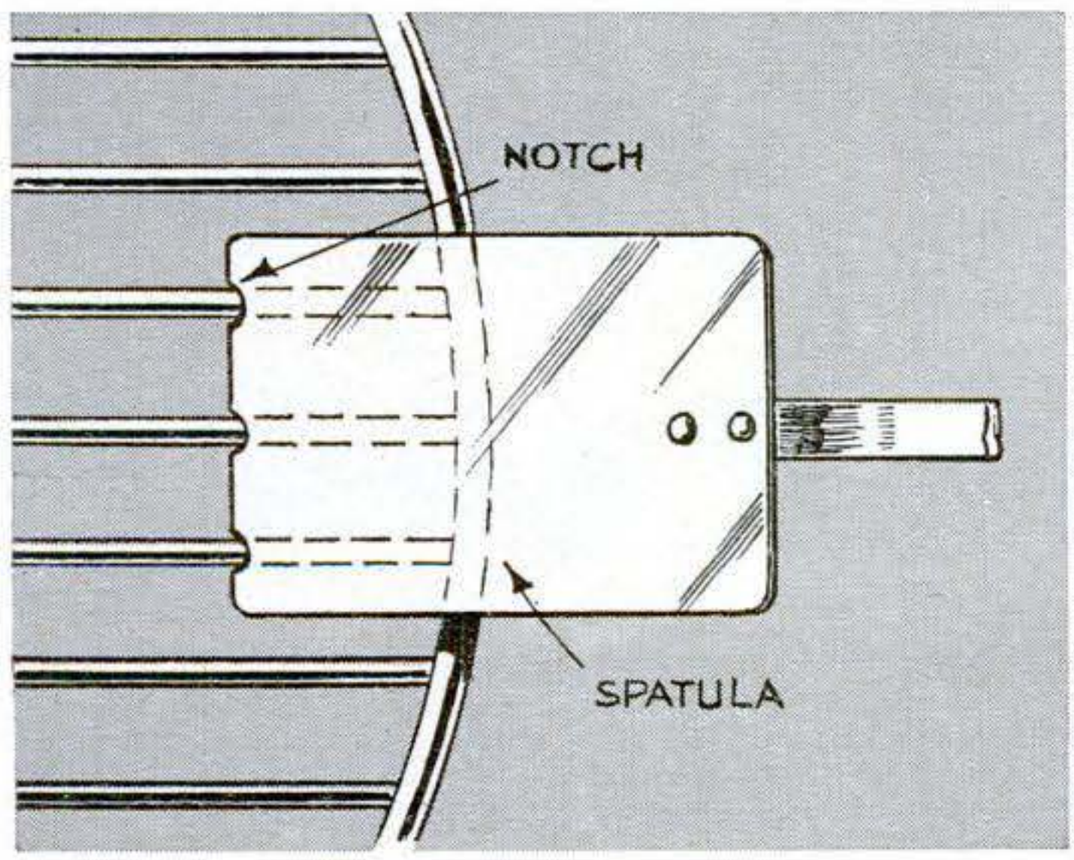
WHEN a shop tool such as a try square becomes so rusty that you can't read the engraved markings, you can refinish it by scouring off the rust and cleaning with fine steel wool. Wipe dry. Then coat with aluminum paint and wipe the surface immediately, leaving the paint in the lines. They will show up like new.—*Murray Kent, Flint, Mich.*



Cushion for Stapler

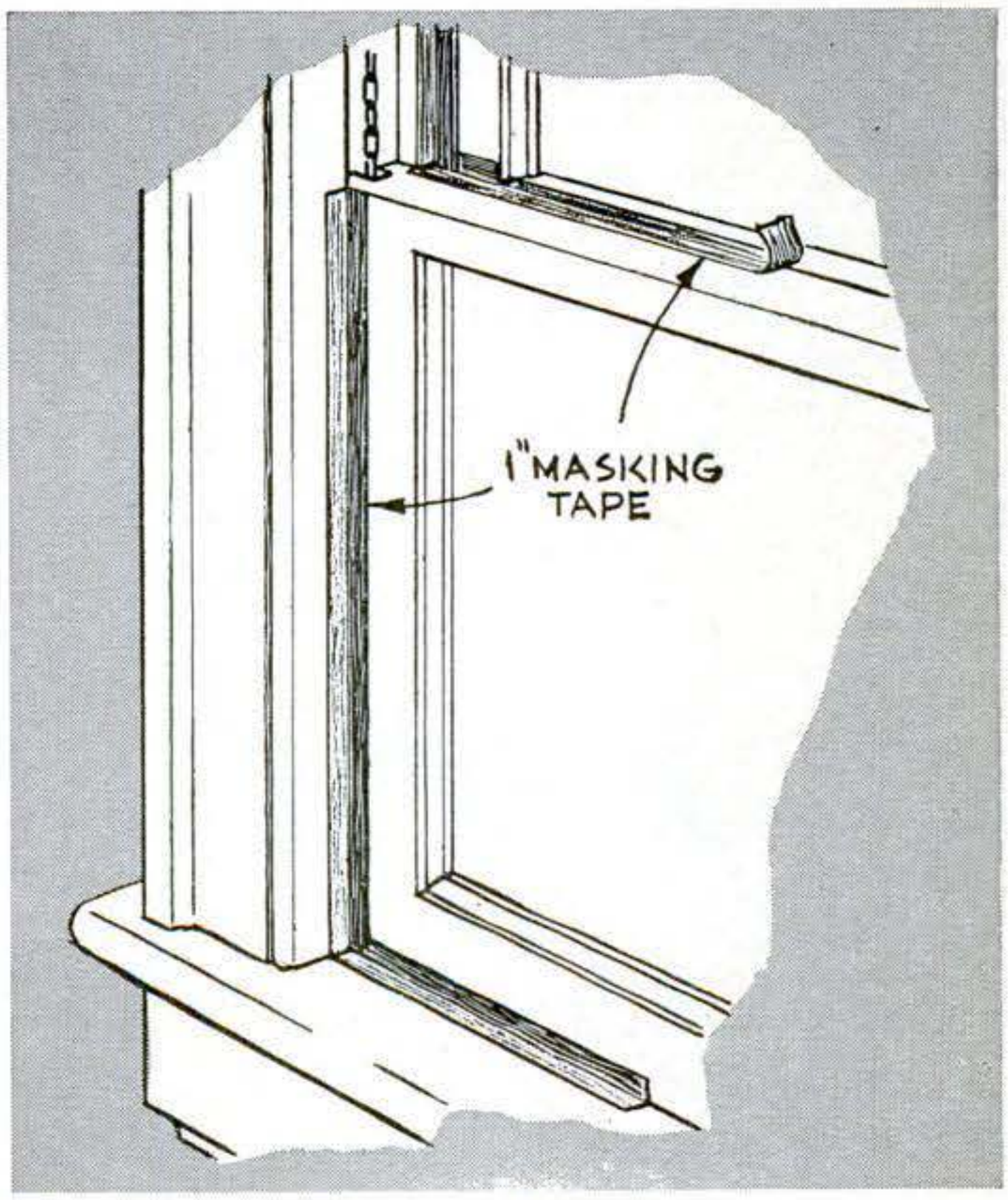
I CEMENTED a 1/4"-thick piece of sponge rubber to the top of my stapler to provide a cushion for my hand. It makes pounding easier when a lot of stapling is to be done.—*Donald Spichuk, Brooklyn, N.Y.*

▶▶▶A BRUSH of the kind used for washing bottles is handy for cleaning on the patio. Dip it in soap suds, and you can coax dirt from plastic and rope lacings and webbings, cushion seams and crevices, wicker and wrought-iron furniture.



Outdoor-Grill Spatula

YOU can lift steaks and hamburgers from a grill with a pancake turner notched to go between the grill rods. Space the notches to fit the rods and cut with a rat-tail file to a depth equal to that of a rod.—*E. Damask, Virginia Beach, Va.*



Draftproofing a Window

A WINDOW that doesn't have a storm sash can be sealed against drafts with masking tape. I use 1" tape to cover the crack between window and frame. The tape is easy to remove for cleaning, costs little to replace.—*Frank Harazim, NYC.*

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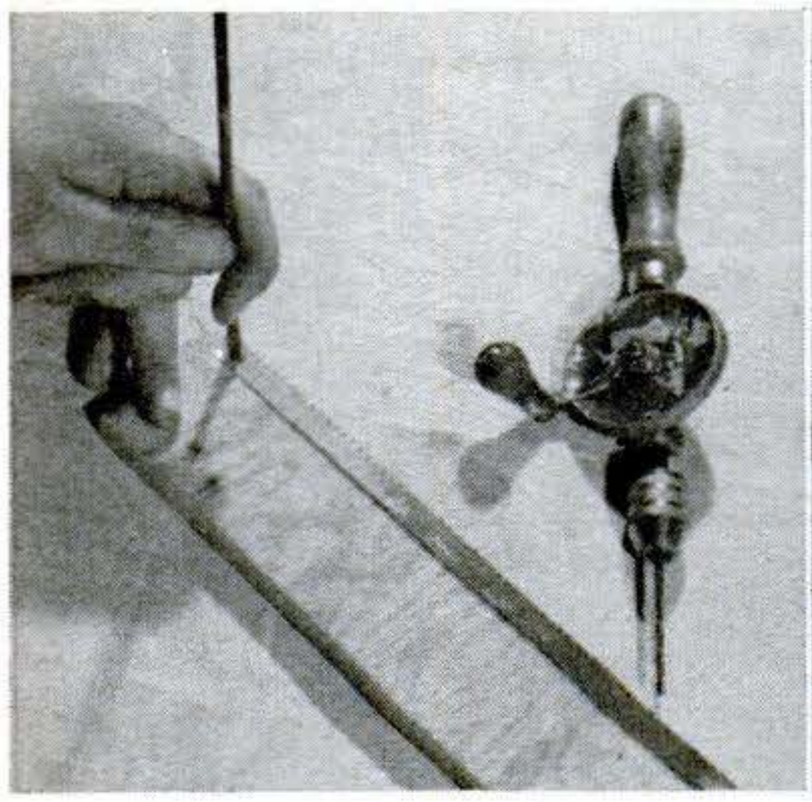
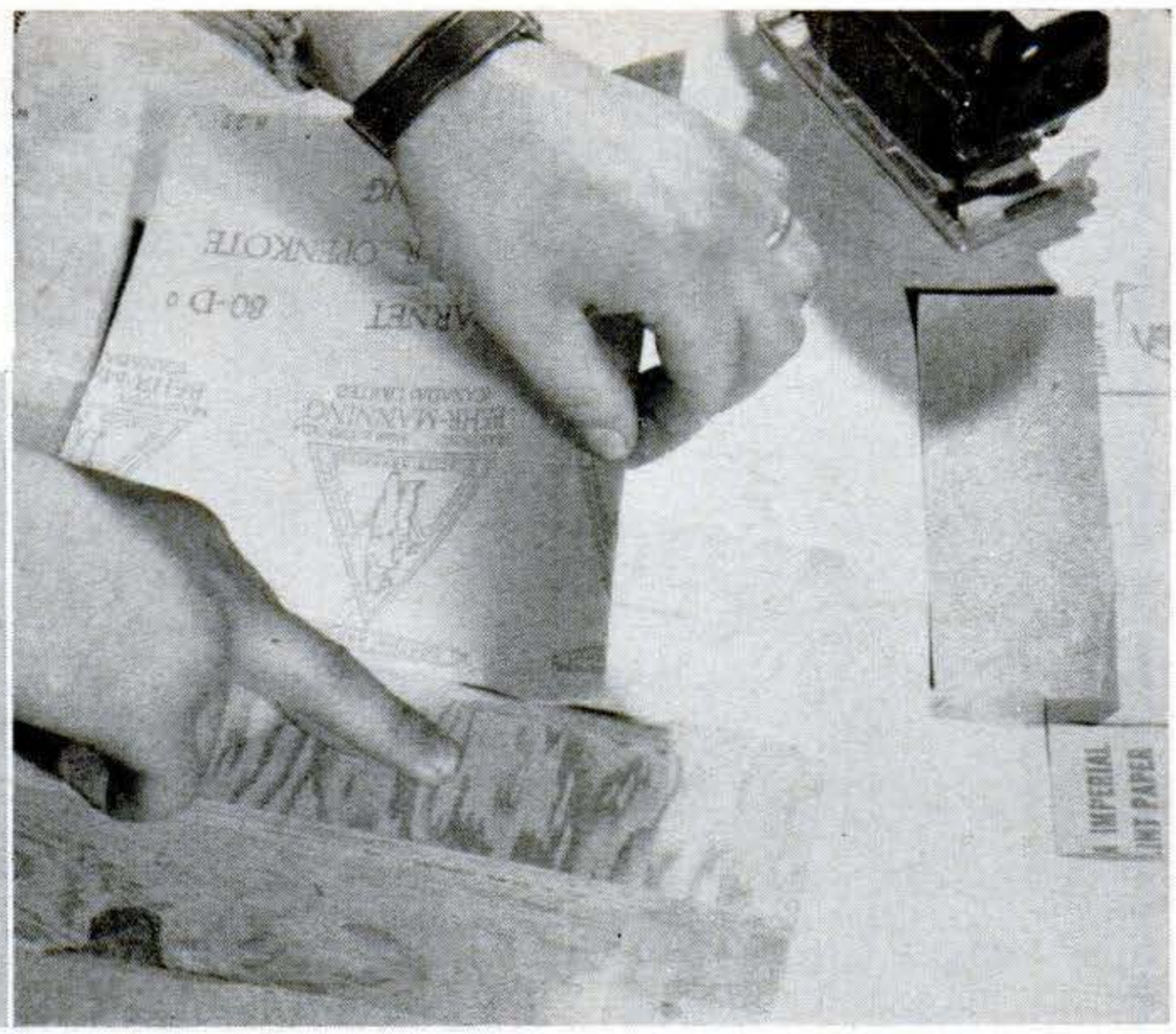
Short Cuts and Tips

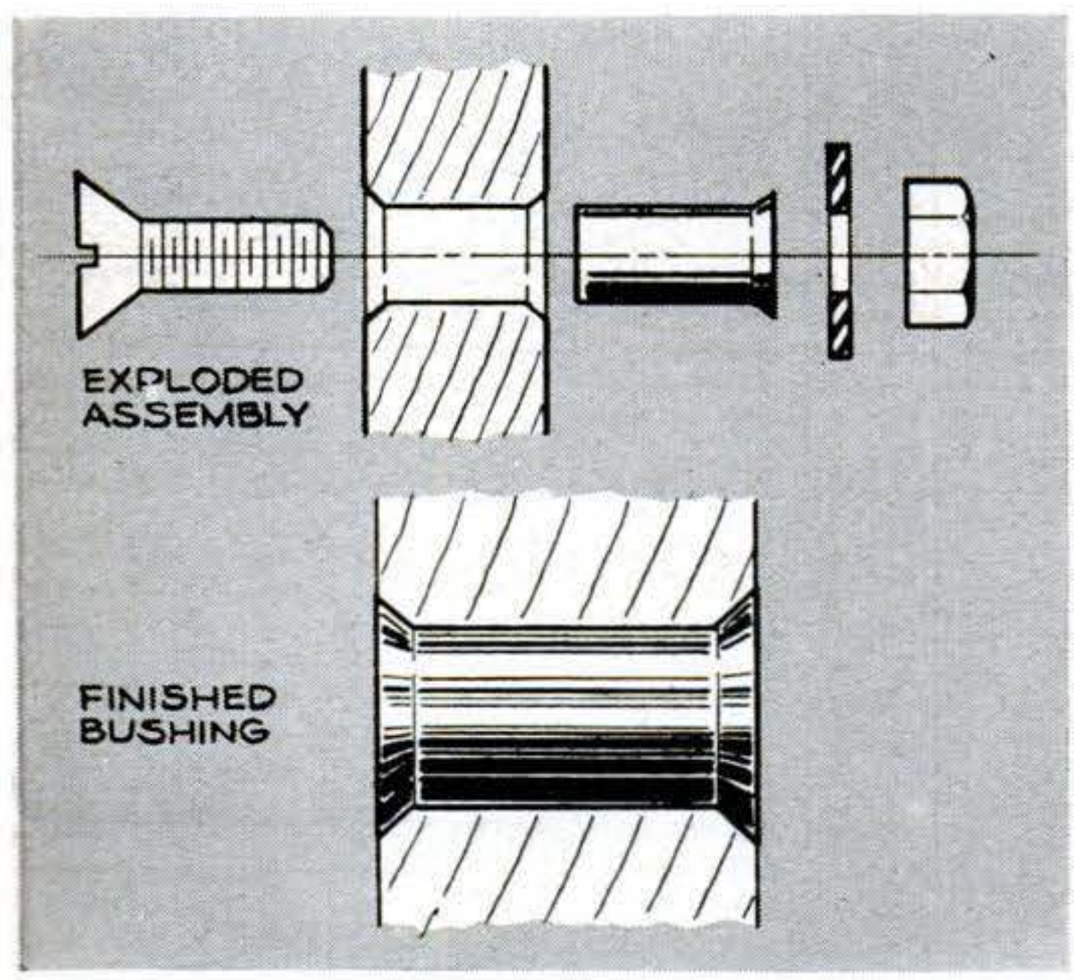
FROM PS READERS





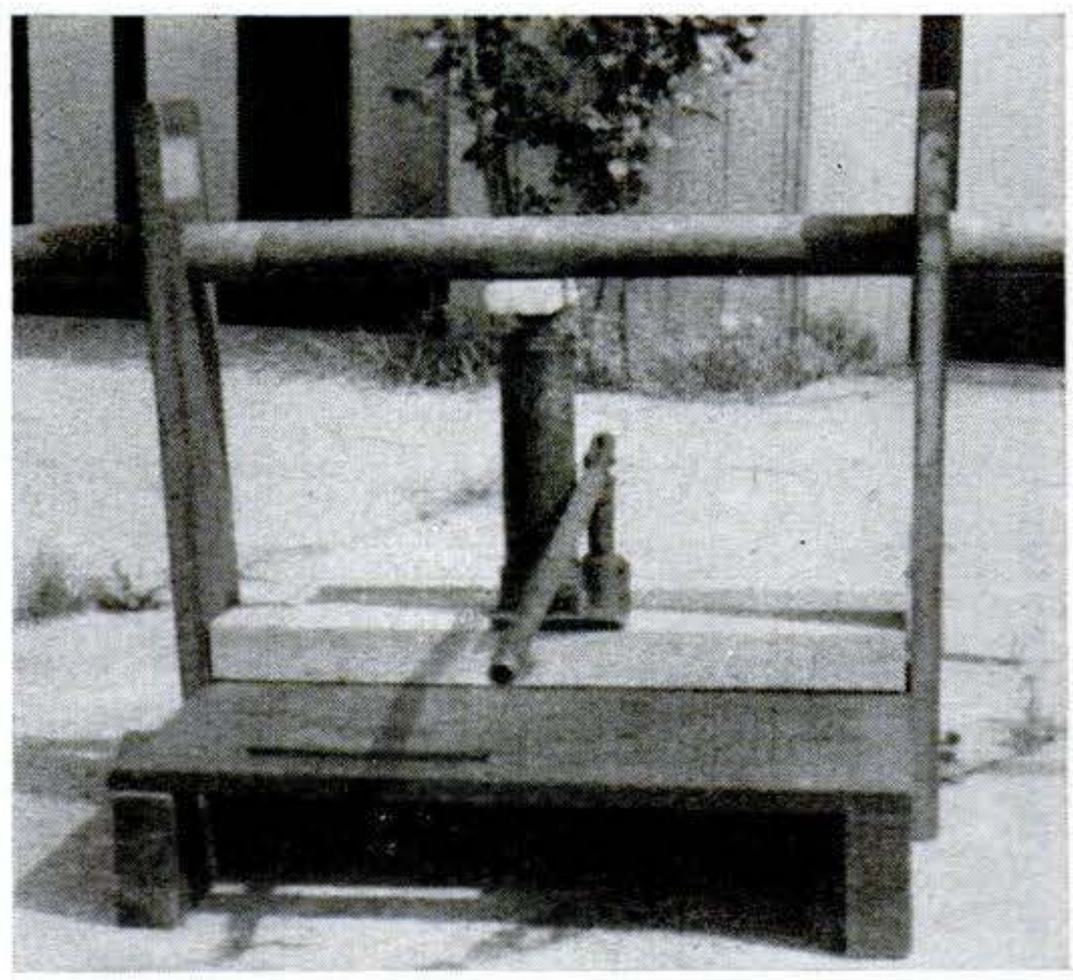
Using a Hacksaw Blade as a Sandpaper-Cutting Jig

TEARING sandpaper to fit your power sander is easy with this simple jig. Fasten an old hacksaw blade, teeth pointing out, to one edge of a piece of ½" plywood the width of your sander. To use the jig, place it, blade side down, on a sheet of sandpaper, with the back edge of the plywood lined up with the edge of the paper. After that—just tear.—*Eric Nissen, Vancouver, B. C.*



Metal Bushings in Wood

A METAL-BUSHED hole in wood, useful for long-lasting wooden pivots or drains, can be made from a short length of soft copper tubing. First countersink both sides of the hole. Then insert a glue-covered length of tube that has been flared at one end. To lock the tube permanently in place, flare the other end by compressing it under the conical head of a snug-fitting machine screw.—*Joseph Whitehill, Easton, Md.*



TV Mast Straightener

WHEN my TV antenna mast was bent in a high wind, I salvaged it with the bending jig above. The jig consists of two boards drilled to take the largest mast section, and bolted to the sides of a two-by-four frame. I slipped a bent section of the antenna mast through the holes, and put a wood-padded jack beneath the bottom of the bend. Raising the jack straightened the mast in short order.—*C. E. Palmer, New Haven, Conn.*

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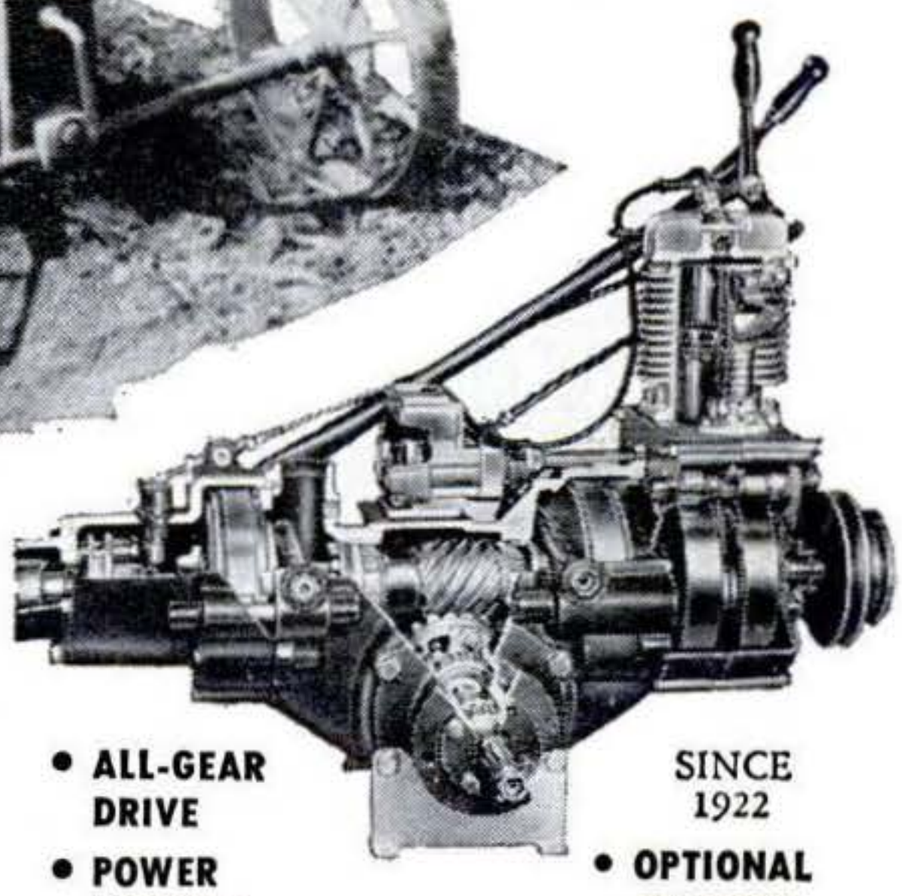

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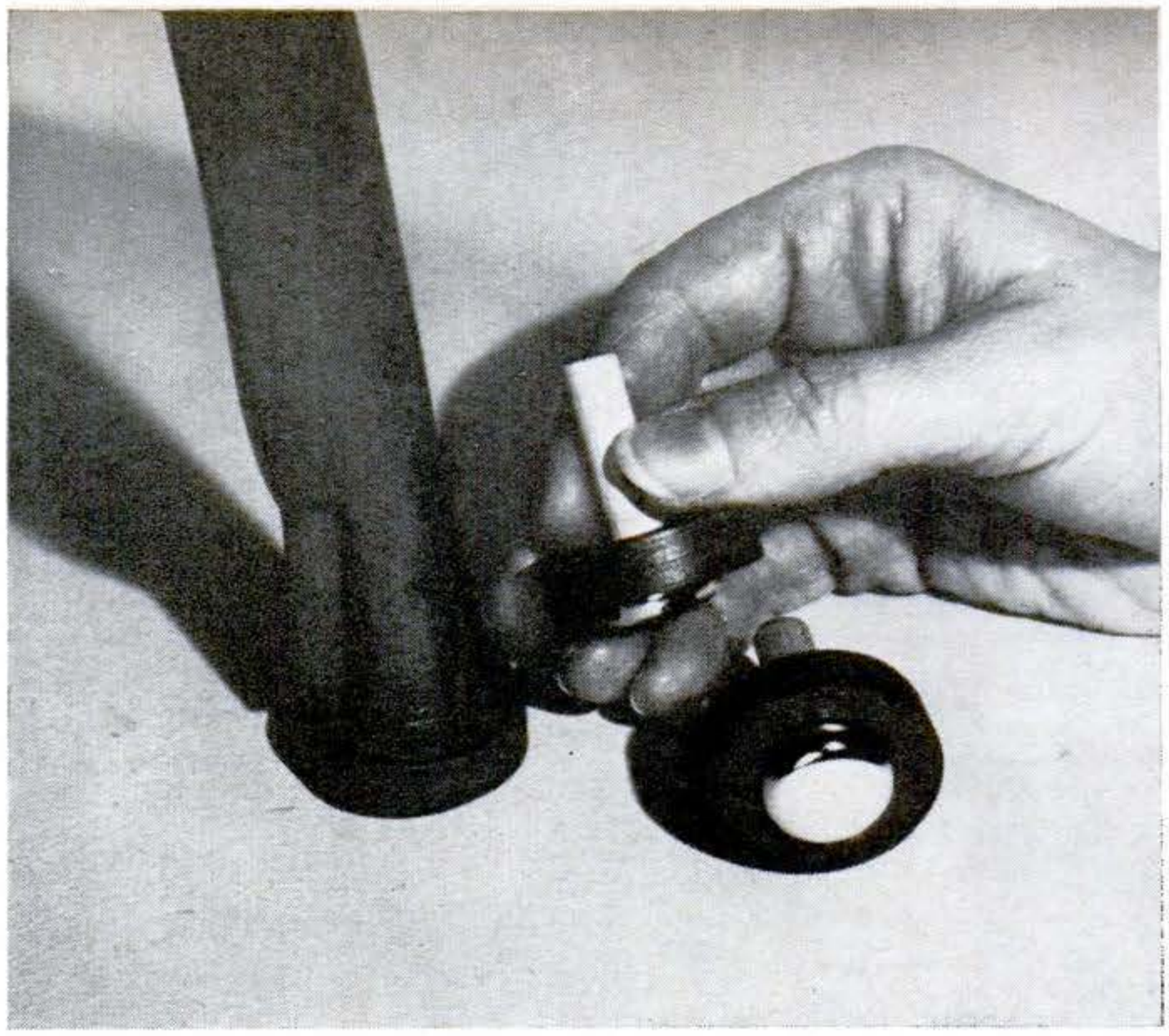
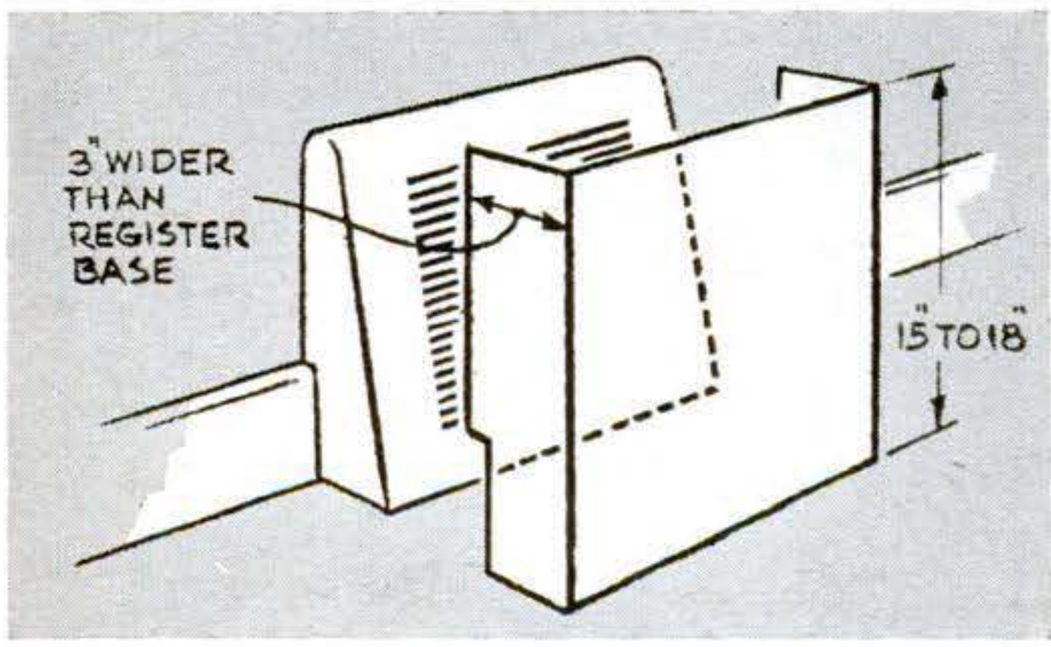
Short Cuts and Tips

FROM PS READERS

Checkers Hold Metal Glides

ROLLER casters aren't too steady on a typewriter table. For a firmer footing, you can replace them with metal furniture glides attached to the bottom of pieces from an old checkers set (left). Drill checkers to take a snug dowel fit. Glue the dowel in and slip it into the caster hole.—*Frank A. Javor, North Bergen, N. J.*

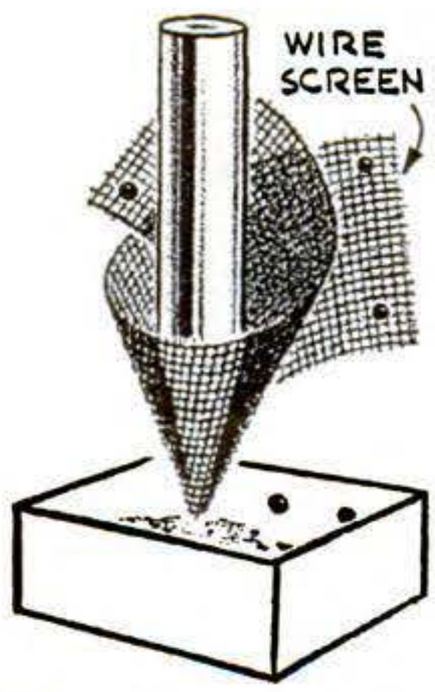




Better Heat from Register

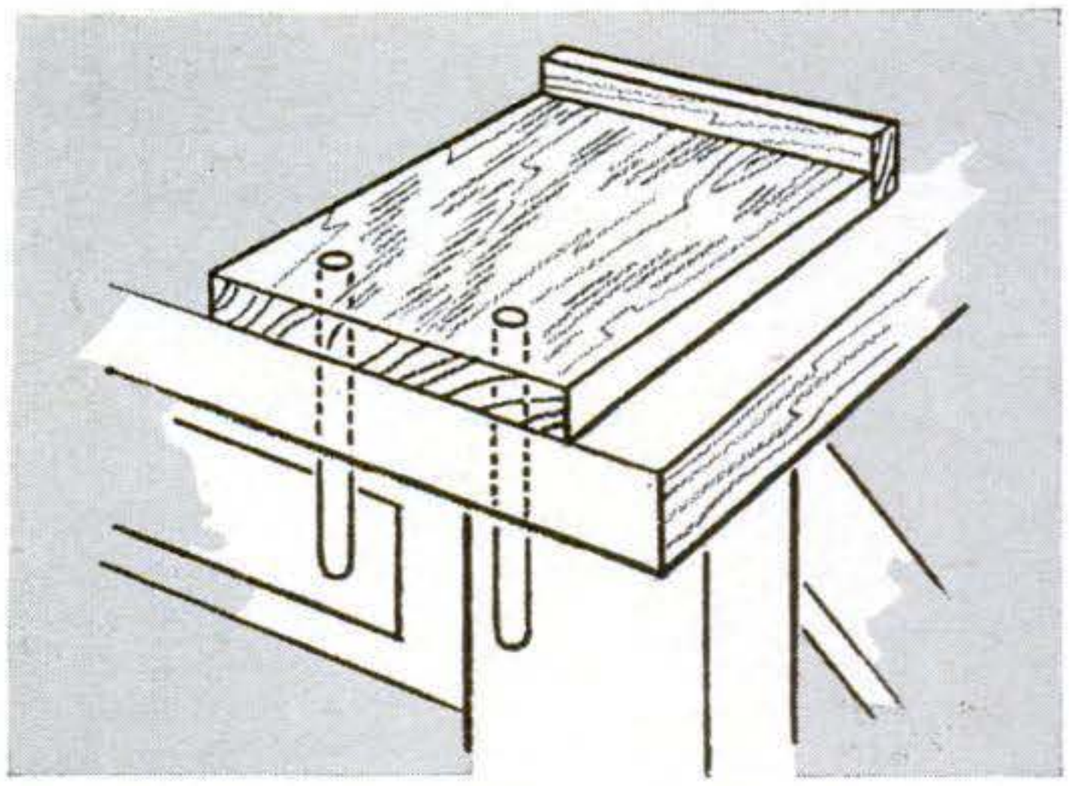
BASEBOARD registers in rooms farthest from a gravity-type warm-air furnace may act as cold-air returns. A metal shield around the radiator prevents this and lets the warm air flow up. Make a trial shield of cardboard. If heating improves, replace it with a permanent one painted to match the room. Fit it snugly against the floor. —*E. T. Roetman, Palatine, Ill.*

Screen to Point Chalk



SHOP crayons and chalk can be kept pointed easily with pieces of screen rolled into a cone. The sharpener can be tacked up at a convenient place. A container placed beneath the screen will catch shavings.—*Jim Knock, Hanley, Sask.*

▶▶▶TRASH and cut-brush fires can become dangerous if they get out of control. A neighboring farmer eliminates the hazard by raking the stuff into a pile and letting it dry. Then he covers the heap with a large tarpaulin. After a soaking rain, he removes the tarp and does his burning. —*James Vick, Petersburg, Va.*



Tight-Holding Bench Hook

WANT to make a bench hook secure? Drill mating holes in the end of the hook and the bench edge. Drive snug-fitting dowel pegs to make your setup as needed. —*G. E. Hendrickson, Argyle, Wis.*

▶▶▶WHEN hanging doors, you'll do well to use an old carpenter's trick. For each foot of door height, allow 1″ from the top of the door to the top hinge, and 1½″ from the bottom to the lower hinge.—*O. L. Long, Costa Mesa, Cal.*

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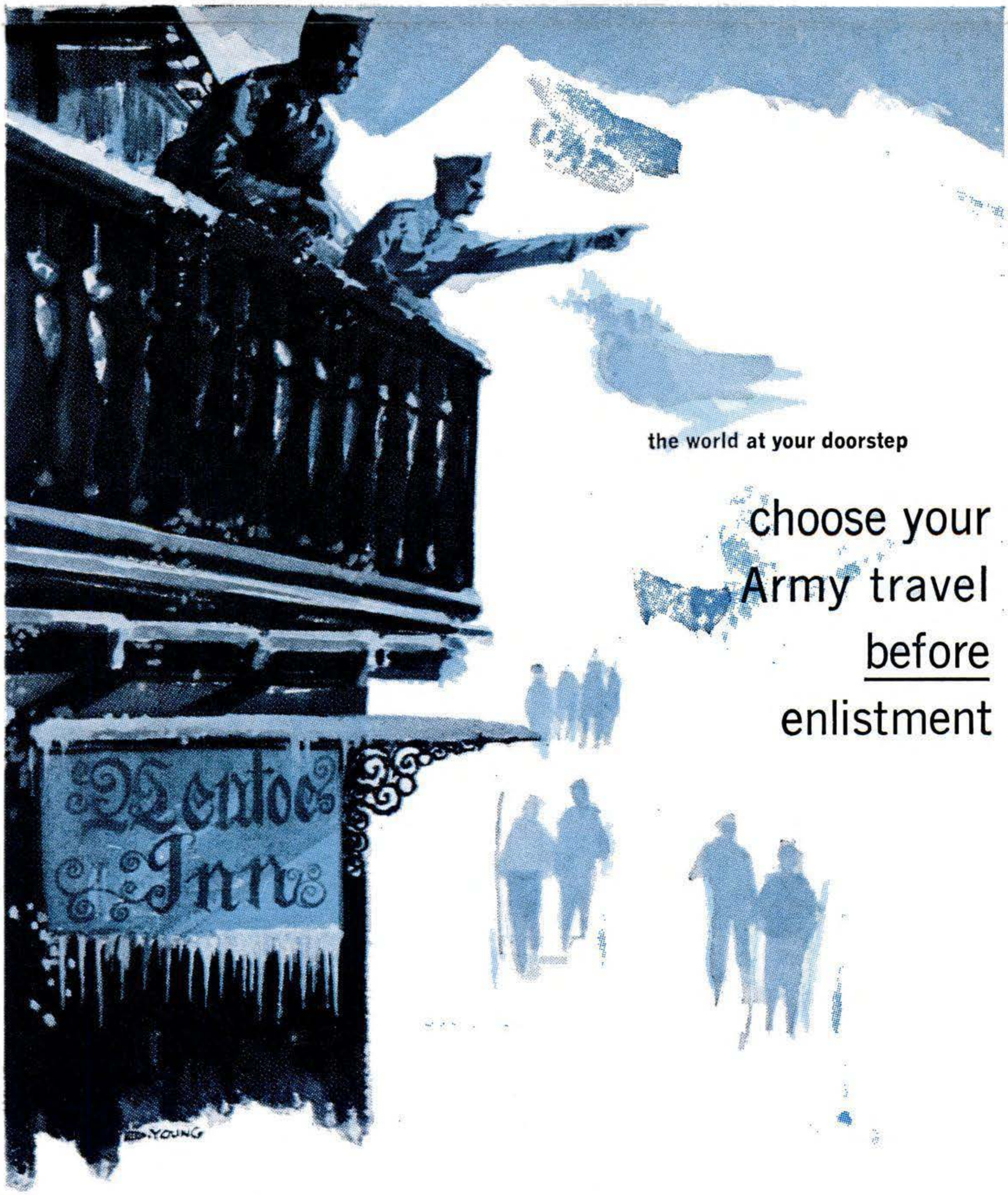

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[Continued from page 89]

month tours of duty will make icecap isolation seem less far away from home.

Some problems solved. Camp Century —so named because its original site was 100 miles out on the icecap—is being built by the Army Corps of Engineers after five years of preliminary construction experiments on the Greenland icecap. Its research programs will be directed by the Army's Chief of Research and Development. The working areas will be dominated by scientific laboratories, but should the need come for a similar military installation—perhaps an under-ice launching site for intercontinental ballistic missiles or interceptors—we have the blueprints, the techniques, the machines. At Camp Century, the Engineers have proved that they can:

- Make efficient use of construction materials at hand—snow and ice.
- Dig cut-and-cover trenching with an adaptation of Peter Snow Millers—huge rotary snow plows that for years have been keeping passes in the Swiss Alps open during winters.
- Adapt mechanical coal-mining machines to carve caverns into ice-hard snow to make expanded quarters, as well as space for storage and food refrigeration.
- Solve the water-supply problem, always serious in the Arctic, by drilling wells 150-feet deep, shooting down jets of steam, and pumping out water.
- Utilize an air-transportable nuclear power plant, with a capacity of 2,000 kw., to furnish light, heat, and power. A core of U-235 weighing less than 50 pounds will produce a year's supply of electricity—doing the work of 35,000 barrels of fuel oil.

One thing the engineers haven't been able to lick is the slow, plastic movement of the ice, which causes the walls to close in and the corridors to twist. With periodic shaving of the ice, they expect the camp to last about 10 years. Then it will be completely reconditioned.

The machines used for this maintenance also will carve out new and bigger storage vaults. Equipment and tools stored in them don't rust, and food keeps indefinitely. With the techniques developed to build Camp Century, the engineers say they could hack out great ice caves to store surplus crops for use by

CONTINUED

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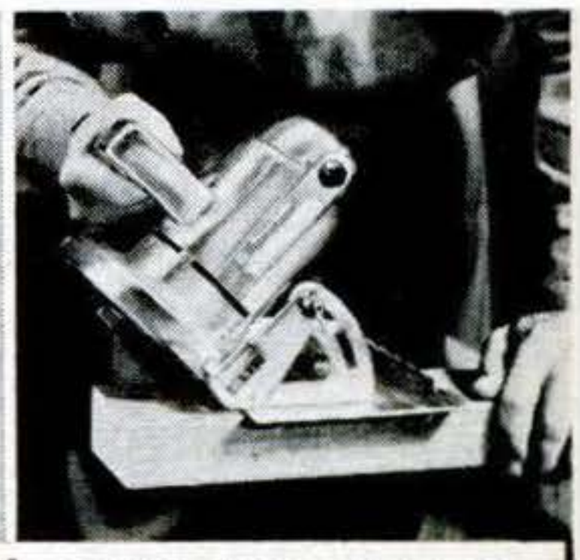
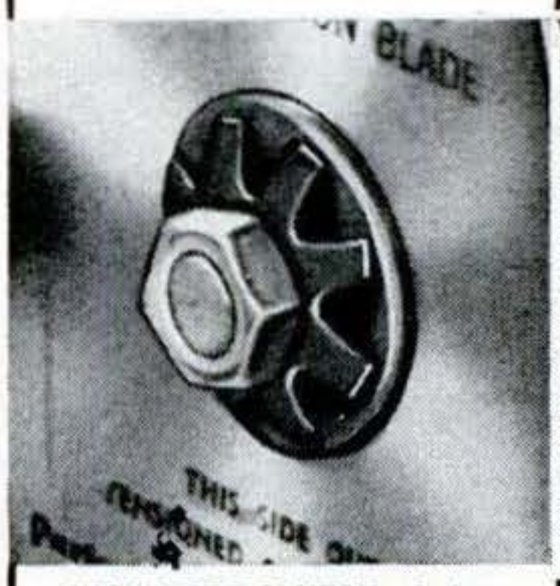


BEVEL CUTS — Model 66 bevel cuts any angle from 0° to 45° — in 2" dressed lumber. Calibrated quadrant for accurate angles.



KICKPROOF CLUTCH—Automatically puts saw into "neutral" if it jams or pinches in the cut. Prevents kickback for all around safety.

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future generations in times of famine.

Why a Camp Century? The Greenland icecap, with a big, permanent supply base at Thule, is the ideal laboratory for studying snow and ice. Aside from weather implications, these are two elements we will be living with more and more. The entire Distant Early Warning radar network (DEW line) lies above the Arctic Circle—from the Kuriles at the western tip of Alaska, across Canada and Greenland. Lessons learned in the North Polar areas can be applied in the Antarctic, now increasingly important.

Greenland, with 708,000 square miles of icecap, two miles deep at its crest, is the birthplace of weather for much of the Northern Hemisphere. By drilling and bringing up core samples of ice formed through the ages, scientists can study the history of snowfalls and get information on the movement of air masses covering thousands of years.

"This information," says Dr. Henri Bader, chief scientist of the Army's Snow, Ice, and Permafrost Establishment, "will enable us to make fairly accurate predictions on future weather cycles."

Air samples from the past, preserved as bubbles, are trapped in these ice samples. One Camp Century project is to try to determine how much air pollution has increased since the Industrial Revolution of the 18th Century introduced man-made smog. Ice cores from a depth of 160 feet contained volcanic dust from the great Krakatoa eruption of 1883 in the Dutch East Indies. And in the three-foot layers of snow that are deposited on the icecap each year, there is a permanent annual record of atomic fallout since Hiroshima.

This year-by-year accumulation of snow-become-ice is easily identified and accurately dated, somewhat as rings tell the age of a tree.

Samples of ice formed from snow that fell when Eric the Red set foot in Greenland in the year 982 already have been studied by scientists. With new thermal drilling equipment that will be used at Camp Century, they hope to go down 10,000 feet. The ice they then bring up will date back beyond the dawn of history —to the days when the footprints of Stone Age man were fresh upon the earth.

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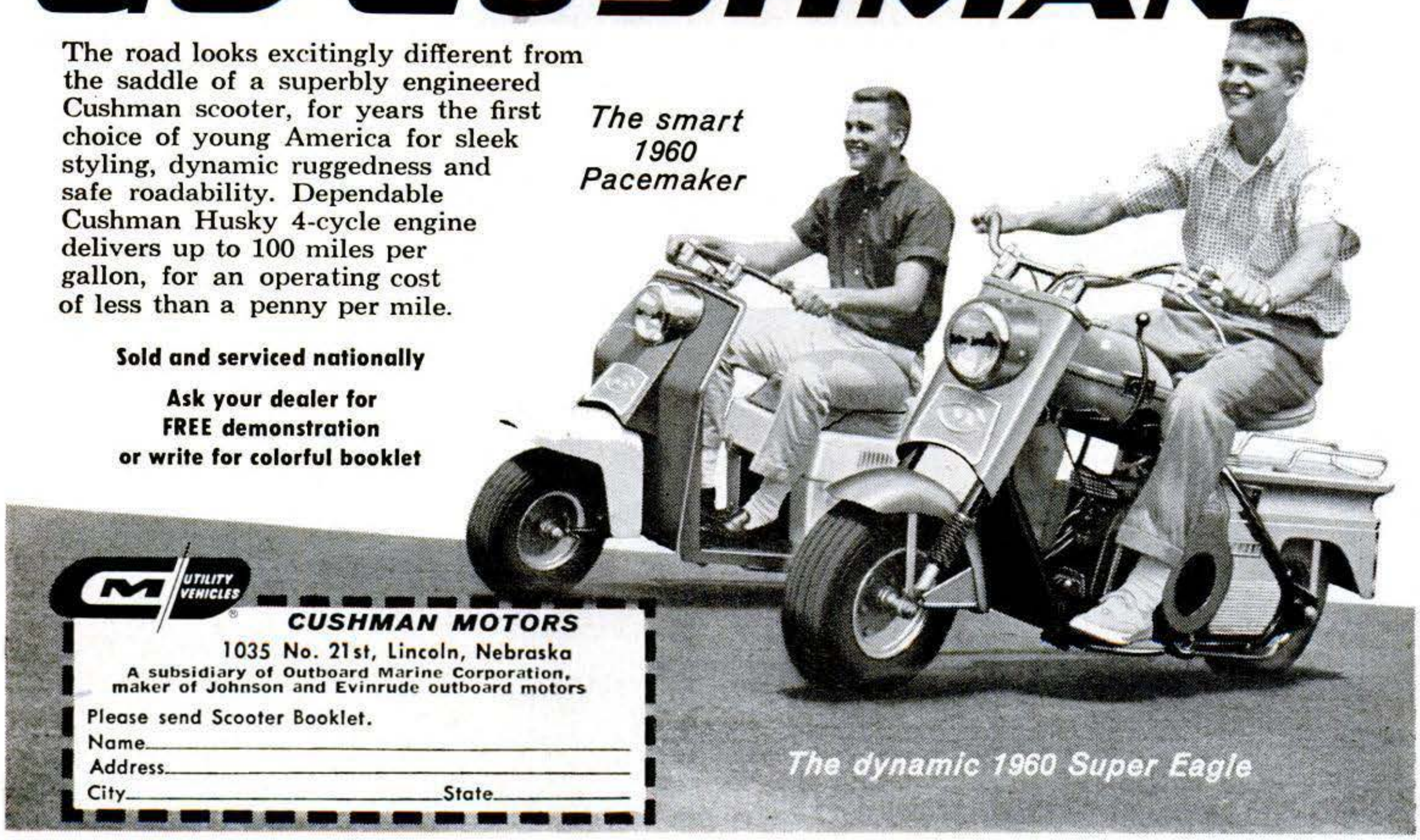

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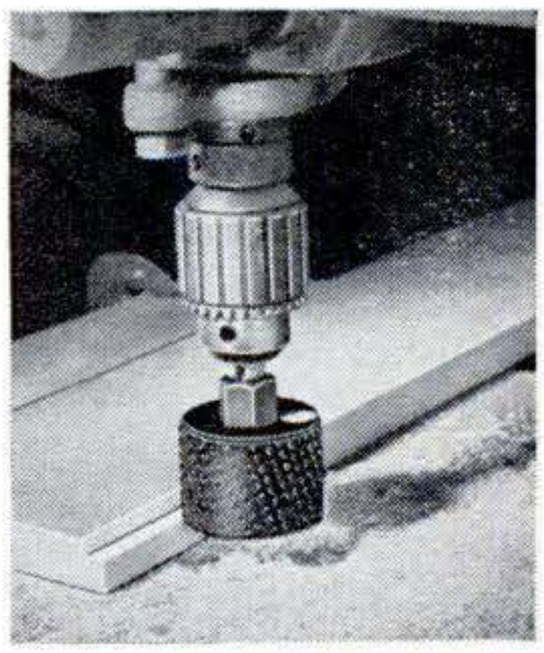

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10,000 Miles in a Falcon

[Continued from page 79]

for even a six-footer like me to get into.

Francis: But the driver's-seat travel is not for a short guy like me. I had to put a cushion behind me to reach the pedals, and then the bottom of the wheel was in my stomach.

Rowsome: Nobody has mentioned the parking brake. It takes a strong pull to set it.

Mann: The trunk is surprisingly big. That's a comfort for a family the size of mine on a trip. And the heater is a blast furnace. The front seat's as hard as a board, though.

Comstock: The ash tray's big enough for a pipe smoker. Overall, it seems to me, we're not doing the Falcon justice on the comfort score. I couldn't have maintained that 556-mile daily average of mine if it hadn't been pretty comfortable.

The Styling

Allaway: For my taste, the Falcon is the handsomest of all the U. S. compacts.

Francis: For mine, give me the Corvair any day. The Falcon is a scaled-down standard Ford. It loses attractiveness in the shrinkage.

In Conclusion

Luckett: For what it's intended for—a smallish and really economical car of limited performance—the Falcon fills the bill.

Rowsome: It's a mannerly, agreeable, easy-to-step-into-and-drive, trouble-free, docile, comfortable, spacious, low-performance car. And a bit unexciting.

Comstock: On a chart covering items of driver comfort, safety factors, and my subjective responses to styling and the creature comforts, I find that I marked 16 of them excellent, 16 good, five fair and only three poor.

Mann: It's attractive and comfortable transportation in the big-for-its-economy, family-size package.

Allaway: I met the Falcon in the worst way—plunging it into after-work, after-dark traffic, without being checked out in it. Yet I felt at ease immediately. It's a handy car for shopping and for ferrying kids around.

Francis: For the conservative motorist who abhors the unconventional, this is the perfect car.

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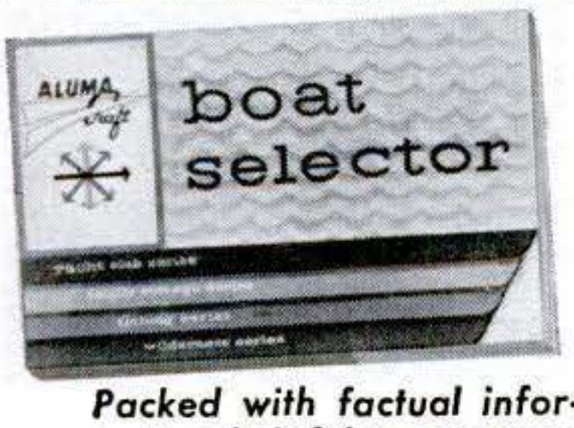

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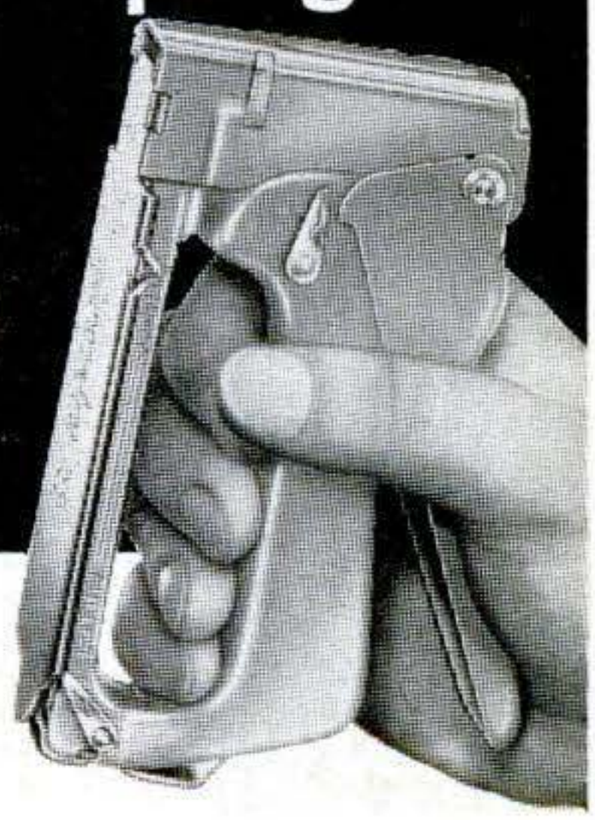

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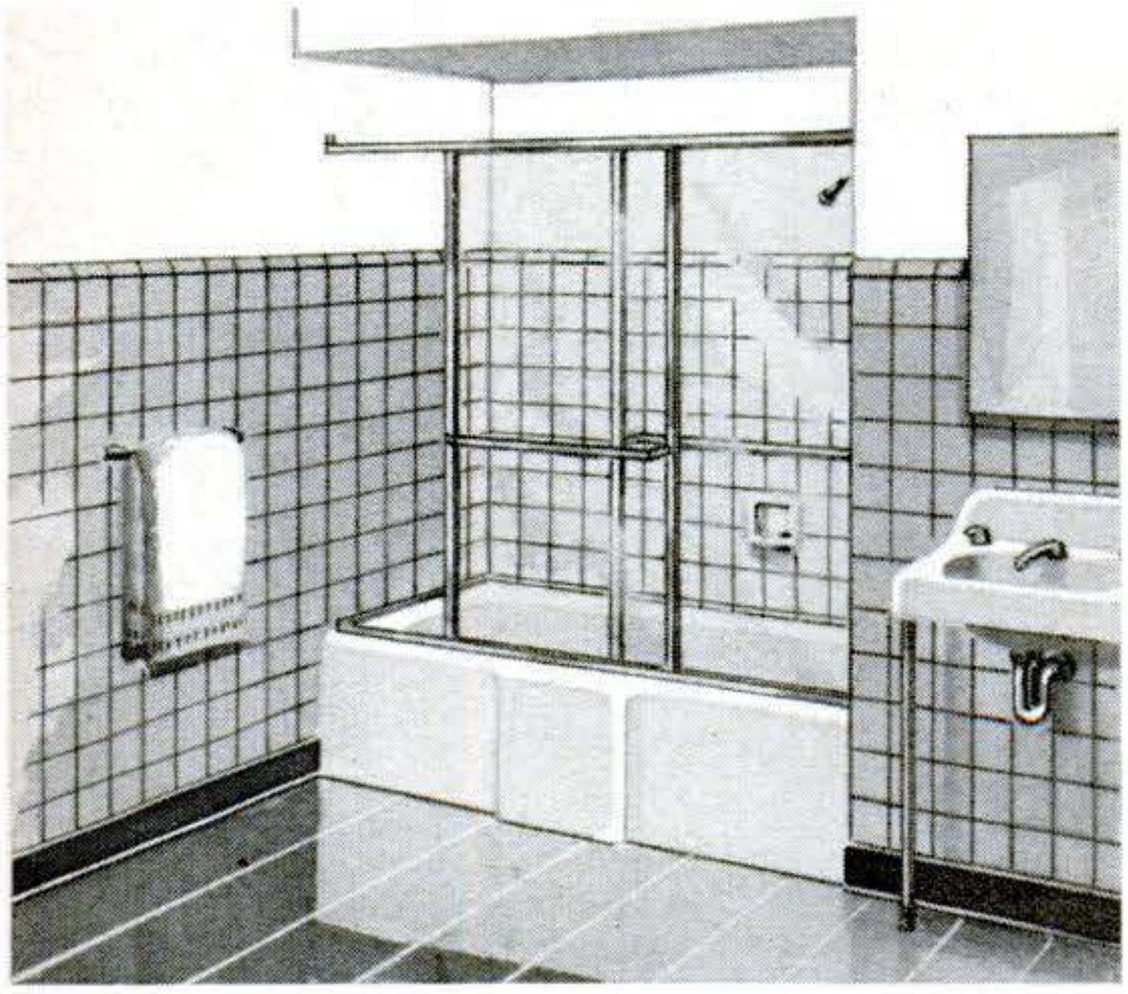

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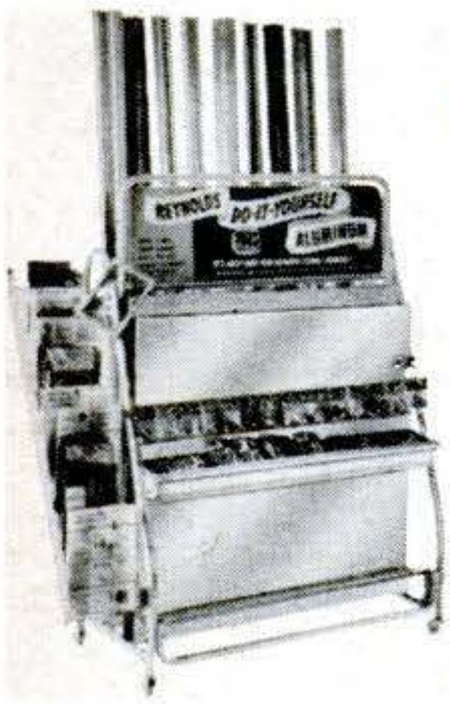

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Magnetic Motor Looks Like Steamer

[Continued from page 151]

ameled magnet wire. Feed the wire evenly across the coil. If it breaks, you can splice it. Make a small soldered joint and insulate it with nail polish.

The coil cover should be made of steel to continue the magnetic lines of flux. The fins should be aluminum—it dissipates heat most rapidly.

You can make all six fins at once by screwing a stack of aluminum sheets to a plywood faceplate. Bore the stack about .001″ less than the o. d. of the coil cover, then shape the fins with snips and file.

Heat a fin with a torch to expand it. Slip the hot fin in place and let it cool. It'll be a tight fit.

Or you can bore the fins oversize and hold them in place with epoxy adhesive.

The engine's "valves"—the breaker points—can be adapted from an old relay, thermostat, or auto-ignition points.

You can build the assembly from scratch by riveting contact points to .016″ spring steel as shown. You'll have to anneal the spring to work it and retemper it afterwards.

The last step is "grinding" the cam and timing the engine. It also can be the most frustrating one. Understanding the engine's operation will help.

An alternating-current solenoid attracts a core toward its center. At top dead center, the engine's piston protrudes above the cylinder. Closing the points energizes the cylinder, attracting the piston downward toward the coil's center.

At midstroke—when the tops of the cylinder and piston are flush—the centers of coil and core coincide. The points must open to allow the piston to coast to the bottom of the stroke.

Re-energizing the coil attracts the piston upward again. Then the power must be shut off at midstroke. The piston coasts back to top dead center, ready for the next cycle.

Let the engine dictate the cam's shape. Mount a blank on the shaft and position the point assembly under it. Set the points so they're closed when the roller is against the blank face.

With the piston slightly before top dead center, scribe a line on the cam through the center lines of the shaft and the roller. This is where the points should close.

CONTINUED

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Rotate the shaft until the piston top is even with the cylinder top—midstroke. This is where the points should open. Mark the cam again. Repeat the procedure on the up stroke.

The four marks on the cam indicate the limits of the cam lobes. With a rotary file in the drill press, cut out the metal between the lobe marks. Don't cut right to the lines, however. Leave a little metal for final touch-up.

At this stage, each engine is different. Final contour is a cut-and-try project. The pilot light will help by telling you when the points are closed.

A curved slot in the cam will permit revolving it about 90 degrees. This puts the power impulses at opposite ends of the stroke—and reverses the engine.

The engine should start by itself if the piston is placed slightly past TDC—a good check for excessive friction.

Return the piston to this self-starting position each time you turn it off. It will remain ready to show off its talents—and yours.

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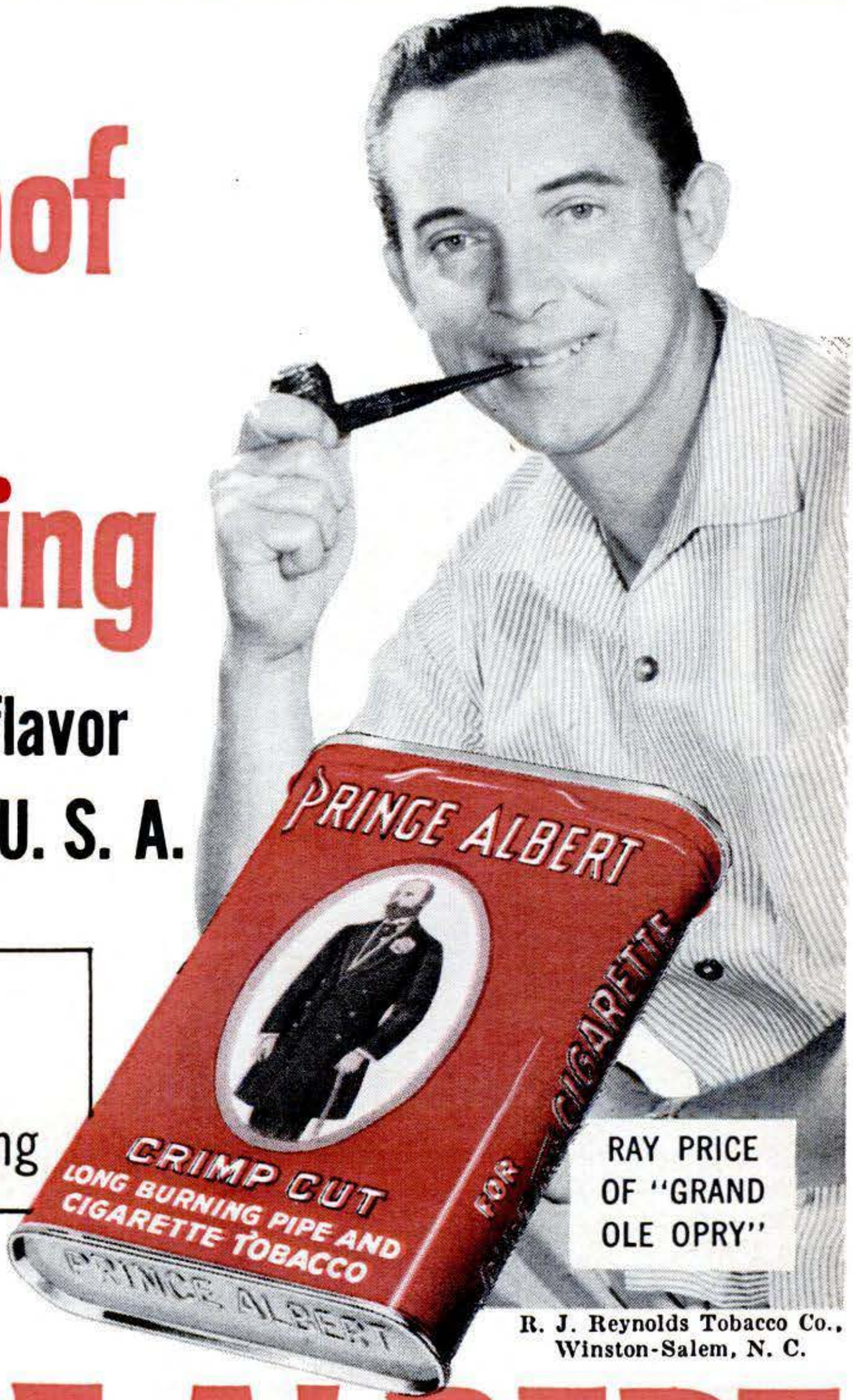

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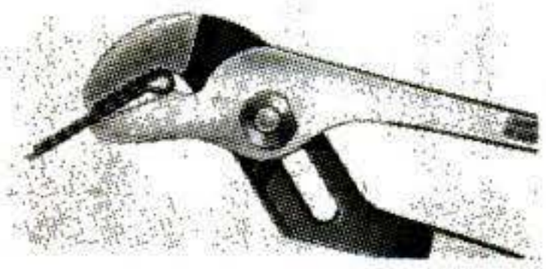

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TV Goes to Tape

[Continued from page 103]

a TV signal and show instead streaks of white, gray, or black dots ("dropout").

Signals from the television camera are transferred to video tape through tiny recording heads that are electromagnets. They magnetize the iron-oxide particles as the tape rolls past, leaving an invisible magnetic pattern that matches the signal from the camera.

When the tape is played back, the recording process is reversed. The magnetic pattern in the tape induces an electric current in the coils of the recording heads. This current is identical to the original signal from the camera.

What the tape recorder does, in essence, is package all the camera's signals and hold them until you are to see them. When that time comes, the tape is played back. It releases the stored signals to the air, and you see them just as if they were coming straight from the camera.

Well, almost. Near-perfect recording and reproduction are possible, but seldom achieved in routine telecasting. The setup is so complex that something usually goes slightly haywire at least once during a show. The defects that creep in are peculiar to tape, and if you know what to look for you can usually spot a taped show by their appearance. For example:

- Dropouts. Imperfections in the magnetic coating on the tape produce white horizontal streaks, irregularly spaced.
- Head switching transients. These look like auto-ignition interference, but can be either white or black. They streak straight across the picture, making evenly spaced bands. The cause is faulty switching as one after another of the four reproducing heads takes its turn in picking up the signal off the tape.
- Waterfall. The reproducing heads must rotate very rapidly. If their bearings wear, the picture moves slightly to create a shimmering effect.

There are lots of other things that can go wrong (see pictures on p. 102 for examples). But the general quality of taped TV is excellent, matched only by the very best of movies made for television, and far superior to kines (movies shot off the face of a TV screen).

Secret of success. High quality in picture and performance is the reason usually given for the rapid switchover to

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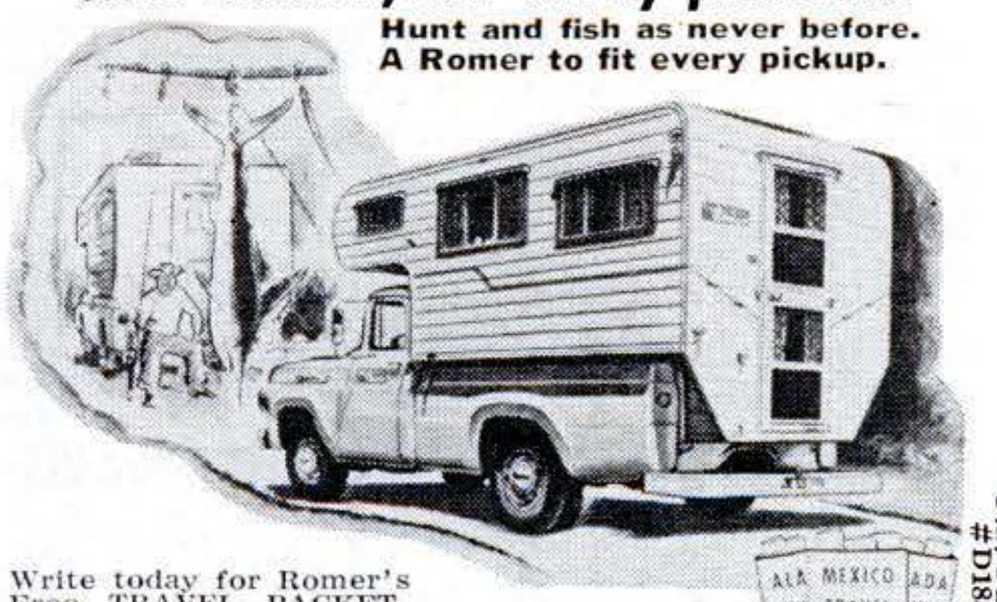

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tape. TV viewers saw their first bit of video tape only three years ago (2½ minutes of the Jonathan Winters show, October 23, 1956). Now NBC tapes more than 30 shows a week, CBS about 40. U. S. stations have bought more than 250 Ampex machines (at $45,000 each, plus $250 for every reel of raw tape).

The quality claim is true enough, but tight-fisted cost accounting also figures in this success story. CBS estimates that taping General Electric Theater was 30 percent cheaper than making movies of it.

The money saving comes from time saving in a business where people get paid by the hour at very fancy rates. One tightly budgeted but widely praised series of two-hour dramas—The Play of the Week—is completely taped, all edited and ready for telecasting, in just three days (not counting outside-the-studio rehearsals).

Tape's principal time-savers are two: (1) The show is edited while it is being shot (by switching cameras from the control room), not afterwards; and (2) processing is eliminated—you can see the results minutes after the cameras halt.

An unexpected bonus from tape showed up during a telecast of a championship pro-football game. It was being aired live, but simultaneously taped. Just before the winning touchdown in the final seconds of play, somebody tripped over a cable and kicked the show off the air. Yet TV fans didn't miss the exciting finale—they saw it a few minutes late, played back from the tape.

Home tapes? It has already occurred to engineers that it would be nice to provide you and me with a combination of TV camera and tape recorder that we could use to make home shows and play them back on our TV sets. To do this with present professional equipment would cost us around $100,000. A tape maker has remarked that the cost will have to be cut more than 100 times before we'll even be interested.

Maybe that will happen within 10 years, he guessed. Argus recently put a small TV camera on sale for $600. And RCA has developed a video-tape player that might cost around $400. It will play back programs through a regular TV set, although it can't do any recording.—*Wesley S. Griswold and Martin Mann.*

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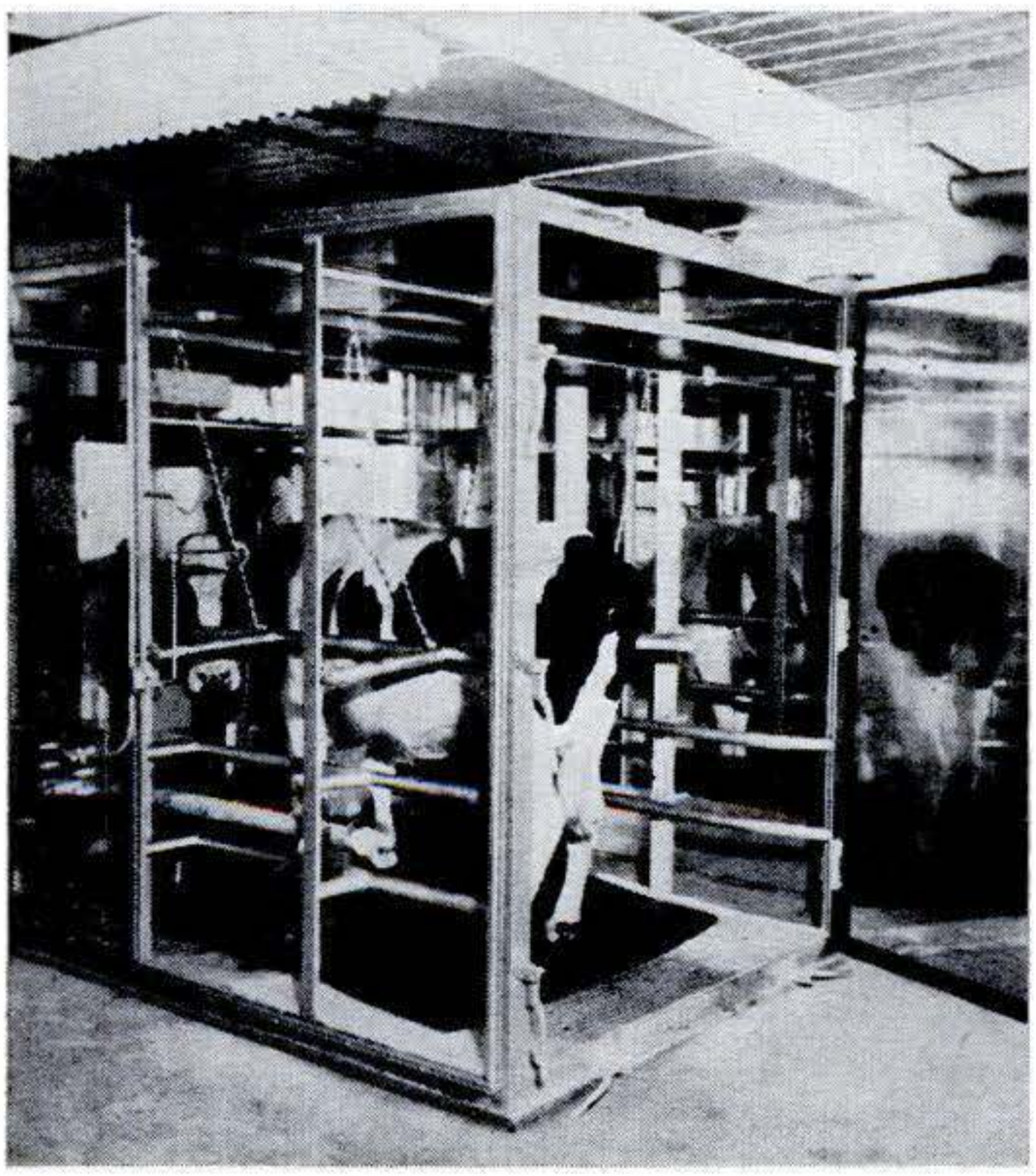
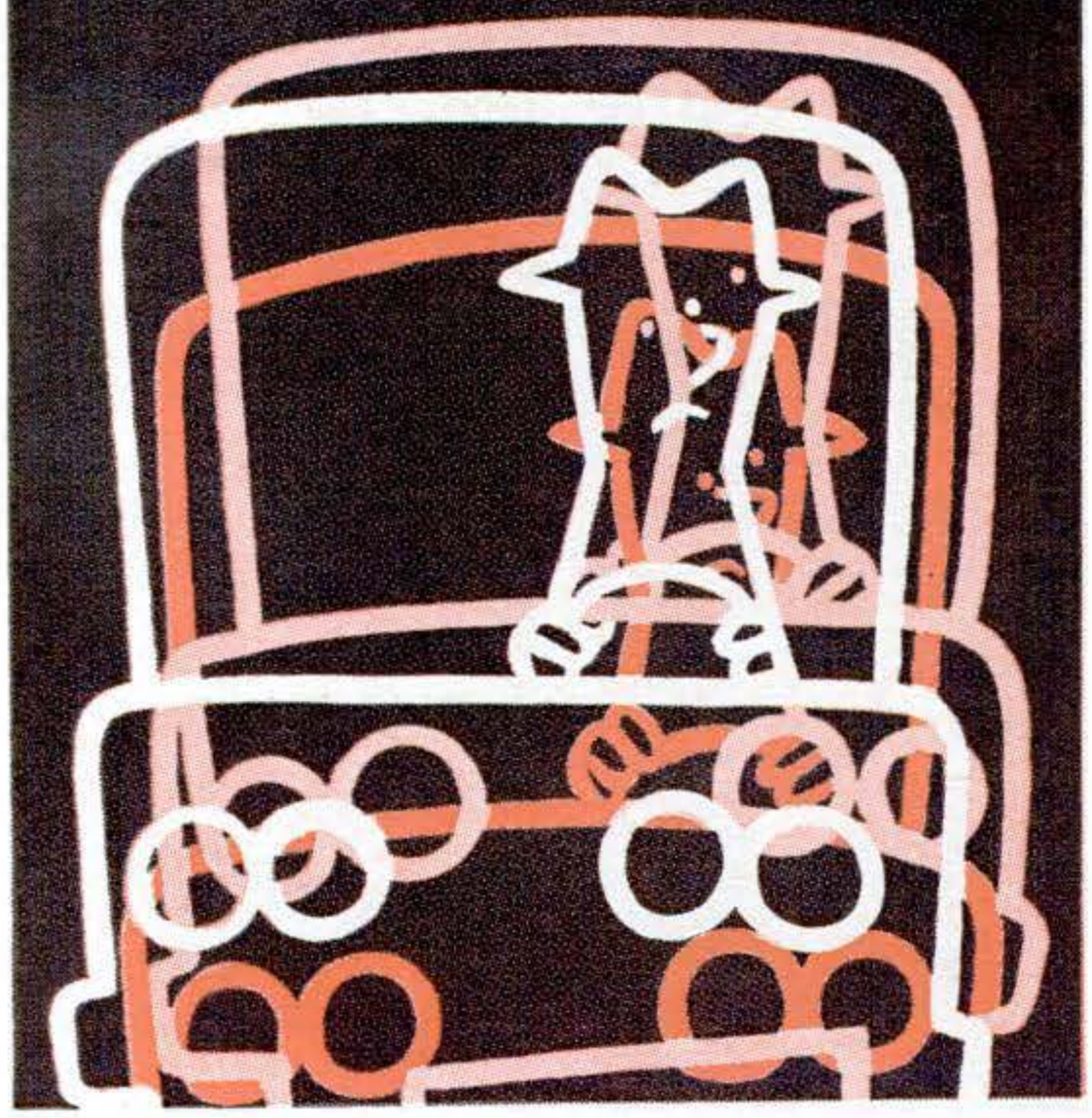
PAVEMENT POLISHER. Here's a combination vacuum and floor polisher that not only cleans a street but puts a shine on the stones. It's used above in front of St. Mark's Basilica in Venice.



PLENTY TO SEE. The U.S. Department of Agriculture keeps cows in clear-plastic stalls at its research center at Beltsville, Md. This offsets claustrophobia, makes cows give better milk.

When rough idling shakes you up...



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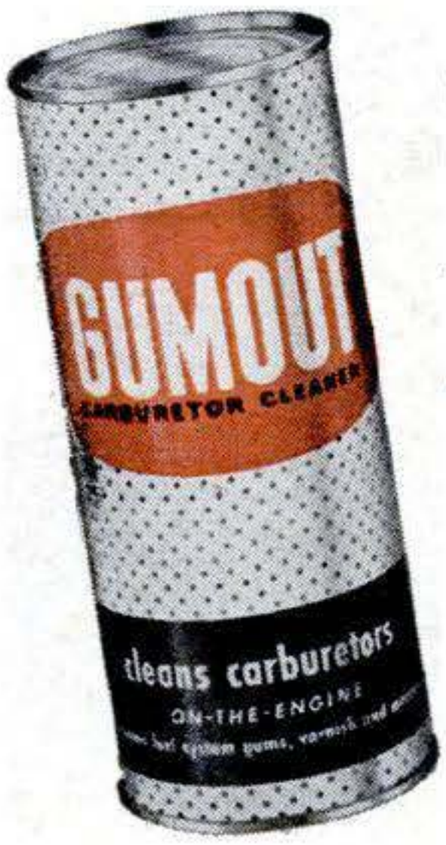

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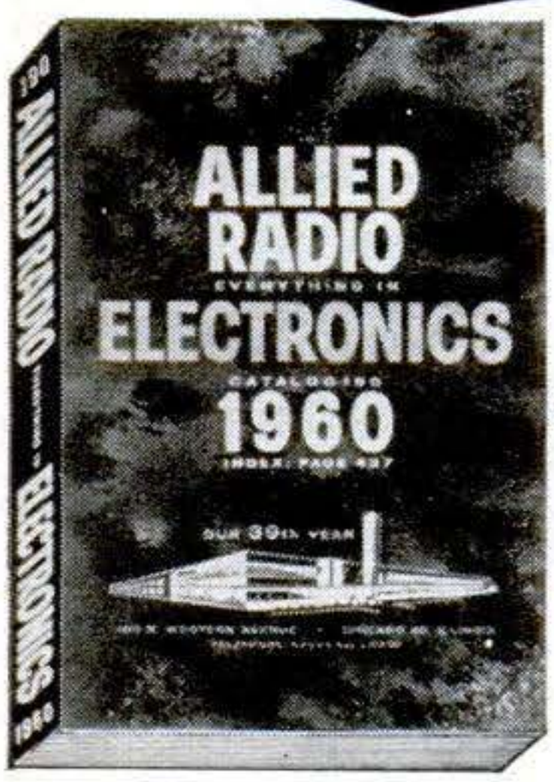

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[Continued from page 108]

subconscious motive for accusing him. Bitter at having been rejected by a number of suitors, she was seeking revenge on them all by making a scapegoat of one.

The judge said he was fully aware that testimony obtained with the use of sodium amytal was not foolproof, but in this case it was too convincing to be ignored. He threw out the case.

In 1959, the same drug played a crucial role in a civil suit. Five years earlier, a young man named John Freeman was found critically injured in the railroad yards at Columbus, Ohio. Both his legs had been severed.

When he had recovered enough to be questioned, shock had wiped out memory of the 36 hours before the accident.

The amnesia persisted. Two months later, he asked Dr. Maurice Rusoff, a psychotherapist, to give him a sodium-amytal interview. In the course of it, Freeman was able to recall all the shock-blocked details:

He and a pal had been watching a college football game on television in a bar. They joined a couple of girls. The four visited a special train that was taking one team and its rooters back home, and joined a lively group in one of the cars. When the train started, Freeman jumped off and began crossing the tracks. A yard conductor saw him and ordered him away. Freeman objected. The conductor pushed him and he fell, hurting his back so that he couldn't get up. A train rolled over his legs.

Fortified with these drug-restored memories, Freeman sued the railroad. By the time the case got to court, the conductor had been dead three years.

Defense attorneys strongly opposed admitting the truth-serum testimony as evidence. But the judge allowed Freeman's lawyers to call in Dr. Rusoff and other specialists to describe the characteristics of sodium amytal and their clinical experience with it. The jury was won in a rush. Though it whittled down the award, it decided in favor of Freeman.

When does it work best?

It releases unconsciously suppressed information far more easily than facts that a person is determined to hide. So

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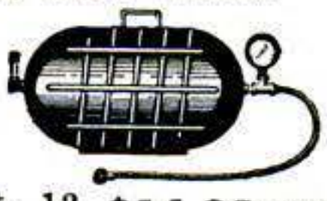

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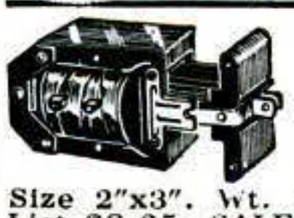

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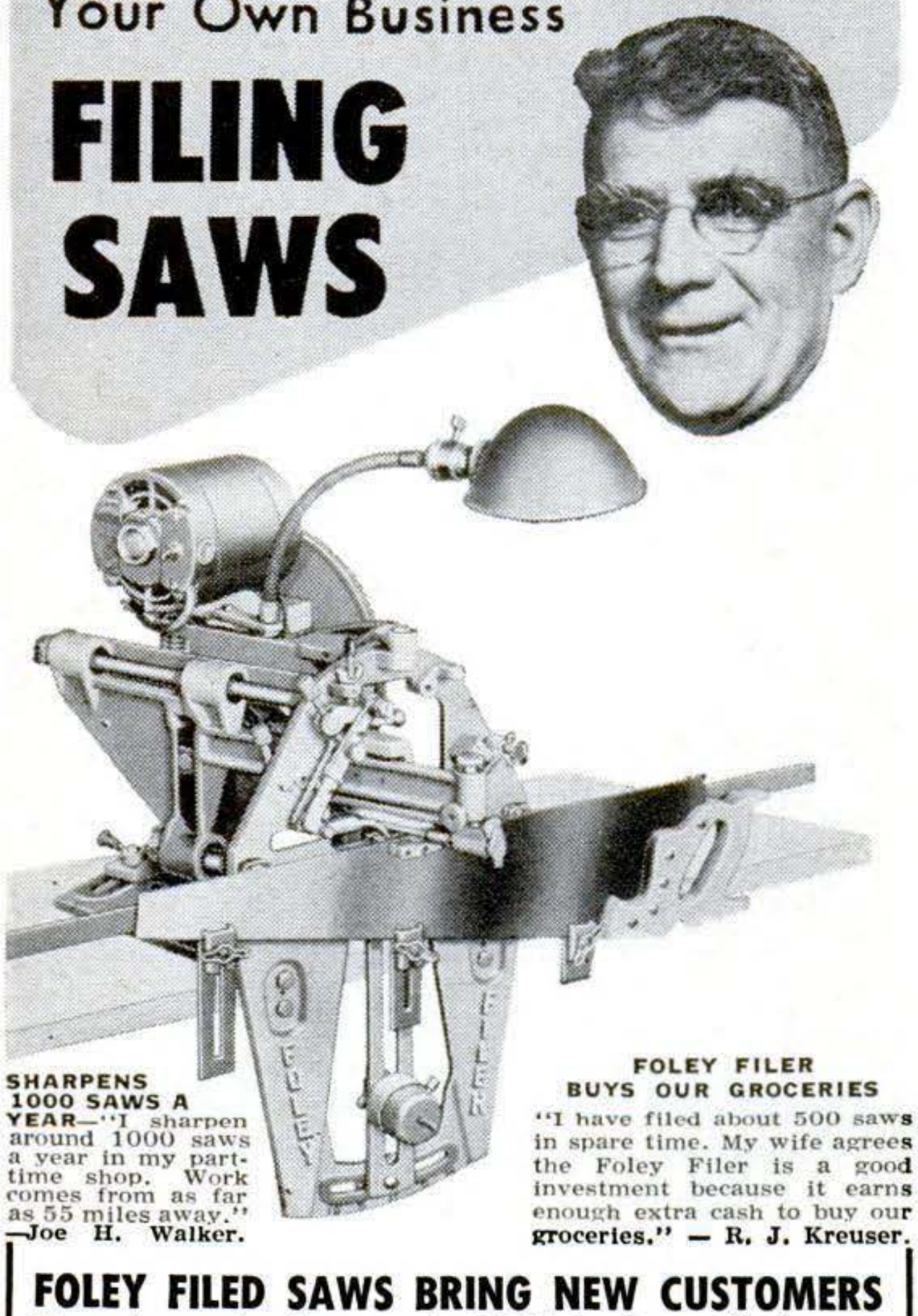

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said Dr. Michael M. Miller of Washington, D. C., after interviewing more than 200 defendants and psychiatric patients with the aid of sodium pentothal.

Earlier, Capt. Alfred O. Ludwig of the Army Medical Corps had reported that it was impossible to break down the falsehoods of desperate liars with truth serum. He had tried in the course of examining soldiers suspected of feigning mental or physical ills to avoid combat.

Other investigators have found that it works especially well with neurotic persons who have strong feelings of guilt, anxiety, or depression. Subconsciously, such a person wants the relief of confession or of self-punishment. When a barbiturate removes the conscious controls of a neurotic mind, it often lets loose a torrent of information.

It also works well in a case of true amnesia, when the victim is eager for help in recovering his lost memory.

What are the serum's drawbacks?

One is that a person in a state of "altered consciousness" is extremely suggestible. He may tell not what is true but what he thinks his questioner wants to hear. Questions must therefore be phrased with great care.

If, for instance, the subject were asked, "You did kill Jane Doe, didn't you?" he might well say yes. But if he were asked, "Did you kill Jane Doe?" he would probably say no. And that answer could be the truth.

Another handicap to the use of truth serum is that there is no sure way to tell how fully under its influence a person may be—unless he's unmistakably unconscious and beyond questioning. If he is still able to talk, he may be only pretending to be unaware of what he is saying.

No two people have the same tolerance for the barbiturates, and an individual's reaction to one of the drugs can't be determined in advance. If a person is a heavy drinker, for instance, his tolerance will be exceptionally high.

For these reasons, authorities stress that testimony given under the influence of truth serum should never be accepted unless it can be corroborated by proper evidence.

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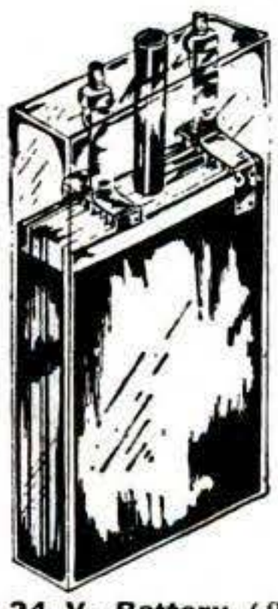

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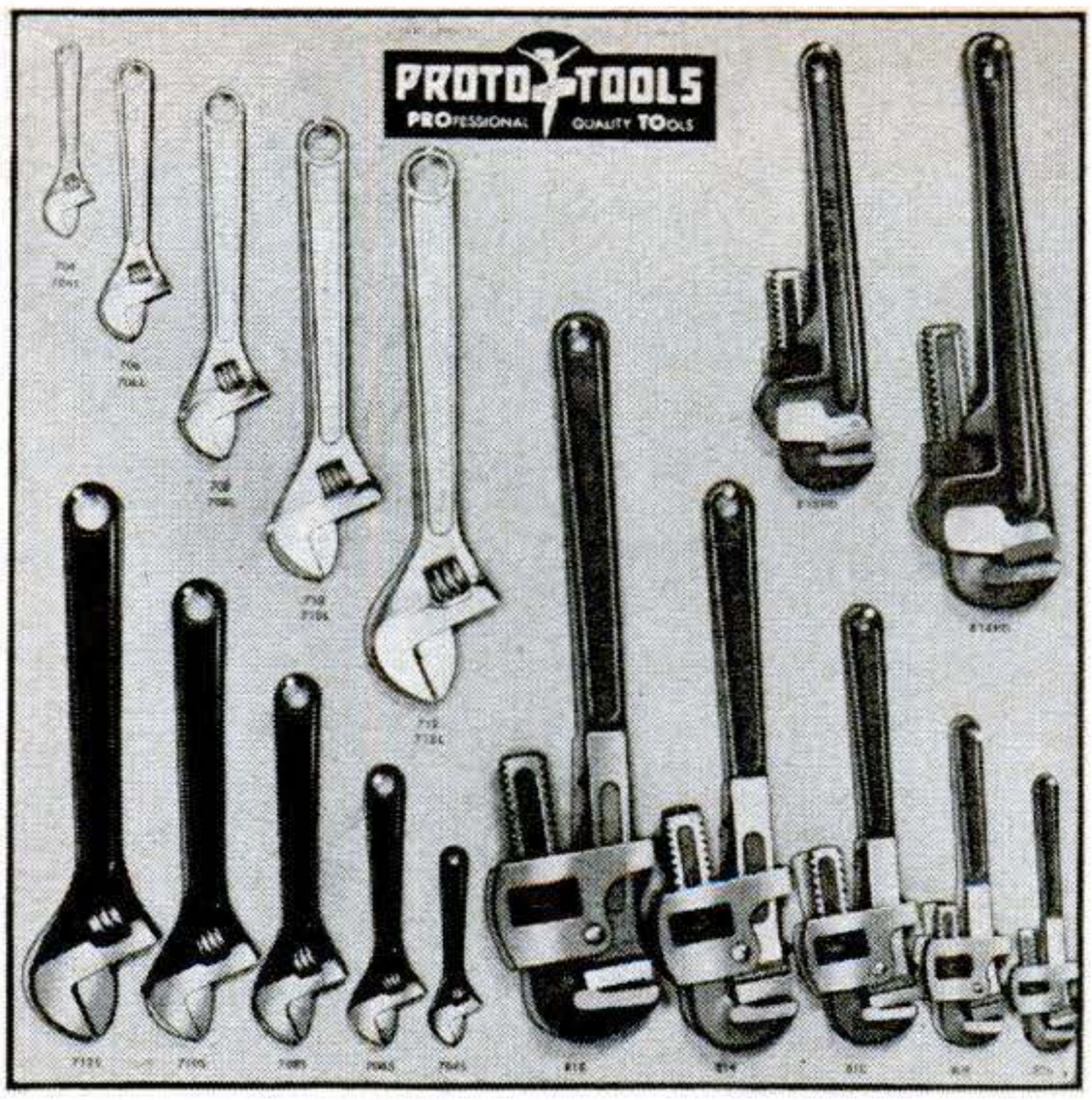

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Knee-Spring Struts for Model Planes

[Continued from page 141]

three spring loops, as shown. The strut is simply a piece of hard-drawn brass tubing with another piece of the next smaller size telescoped inside it, the two being connected by the knee spring.

The ends of the spring are bound to the tubing with close-wrapped, fine copper wire, then soldered. The difficulties usually experienced in soldering music wire can be eliminated by sanding the wire to a rough, bright finish and by the sparing but thorough use of noncorroding solder paste.

No definite tubing diameters are given because the size used will depend on the plane. Best rule is to use the largest diameter that suits the scale of the model for the fixed part of the strut. For the sliding part, use the next smaller diameter. Make the telescoping engagement as long as possible.

Wire sizes for the springs can range from about .02" to .04" depending on the desired stiffness. The knee spring alone is quite effective in maintaining front-to-back alignment of the two tubes, in most cases entirely preventing caster shimmy, provided the length of the spring legs is roughly equal to half the diameter of the landing wheel.

The upper ends of the struts can be cemented into solid balsa where there is sufficient thickness for a strong mount. If not, they can be wired and cemented to plywood bulkheads mounted in the fuselage or engine nacelles. In most cases, additional stiff-leg wire braces are run diagonally to the struts for extra strength.

One of the most useful designs is called the "terminal-compression strut" because the spring is fastened to the terminal point, or lower end, of the strut. This makes it easy to solder the wheel axle directly to the lower tube. It also has a happy resemblance to the trailing shock-absorber arms found on full-scale planes.

The telescoping tubes must be kept working smoothly. For lubrication, use a semi-liquid mixture of light oil and powdered graphite squirted into a small hole in the outer tube.

Properly made, the knee-spring strut will withstand an incredible amount of punishment and will well repay your time in many hours of safe, happy landings.

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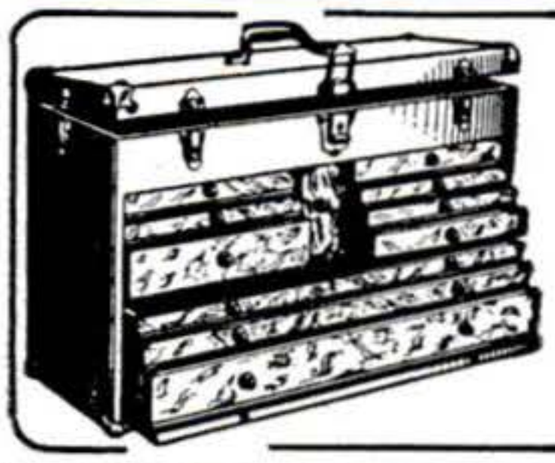

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Are U.S. Front-Drive Cars Coming?

[Continued from page 99]

almost the same type front-drive unit as the L-29 Cord that served as pace car that year. Fred Frame won with a similar car in 1932. Lou Moore's Blue Crown Specials, all front-drive cars, dominated the early postwar Indianapolis events—winning in 1947, '48, and '49. The powerful Novi cars were originally front-drive machines; they were converted to rear drive just a few years ago.

And in Europe. Present stronghold of front-wheel-drive cars is Europe. Such makes as Citroen, Panhard, DKW, Auto Union, and Saab have used nothing but front drive for years.

The Citroen DS-19 and ID-19 models are the most significant of the front-drive foreigners, because of their advanced engineering features and because they are closest in size to U. S. cars. They weigh about 2,500 lb., about the same as Corvairs and Falcons. They are 189 inches long, just two inches shorter than Rambler. They are noted for their excellent riding and handling qualities.

Even such companies as Peugeot of France and Alfa Romeo of Italy, which still build only rear-drive passenger cars, find front-wheel drive attractive for certain applications. Both build light vans, using their regular passenger-car engines, with front drive. The absence of drive components under the body makes for huge cargo space, relative to outside dimensions, and permits very low platform loading heights. (The same would be true for station wagons, which accounts for the front-wheel-drive gleam in the eyes of many Detroit engineers and stylists.)

Activity in Detroit. Reports that Ford will switch its whole line to front drive by 1963 have already been published. (But then there have been rumors that the Comet, Ford's second compact car, due this spring, would have front drive—and that's definitely not true.) Three things are sure:

1) Ford is spending a lot of time and money investigating front-wheel drive.

2) The company's loud talk against rear-engine, rear-drive cars means it can't go that route if it decides to forsake the conventional front-engine, rear-drive arrangement.

3) A Ford supplier is tooling up for

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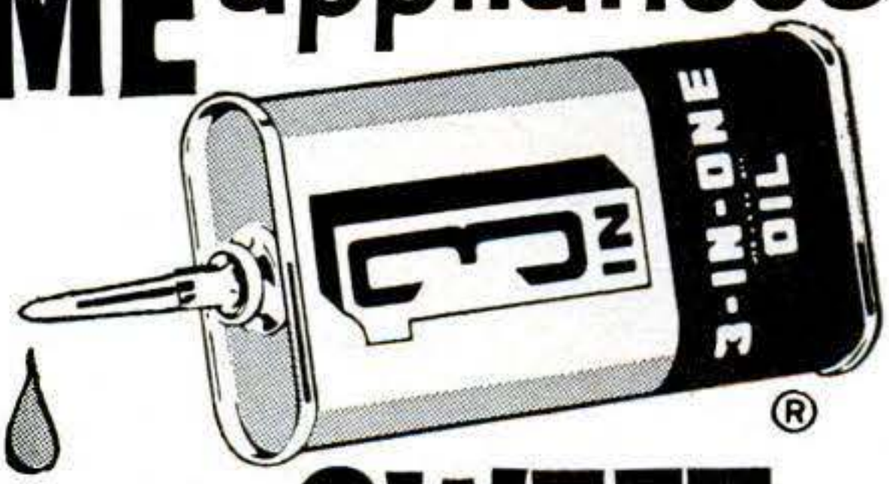

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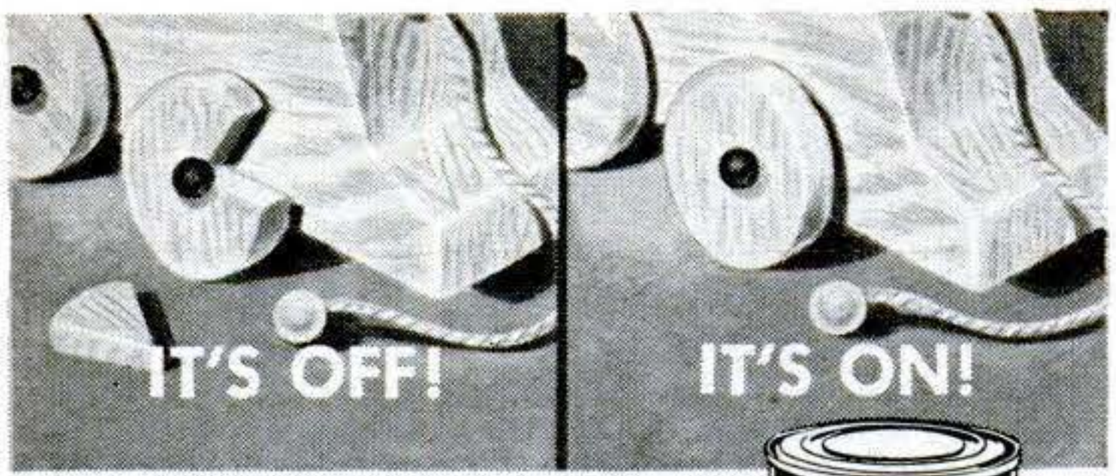

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high production of the constant-velocity U joints that would be needed.

General Motors and Chrysler show few outward signs of current interest in front-wheel drive—though both have experimented with it in the past.

GM's LaSalle dream cars of a few years back were originally designed with front drive, though they reverted to more conventional design before being shown publicly. Another GM Motorama dream vehicle, L'Universelle, a light truck, also had front-wheel drive.

American Motors officials look blank when front-wheel drive is mentioned, but it would be a natural for the little Metropolitan line.

Watch the Corvair. One factor that likely will influence the future of front-wheel drive in this country is long-term public reaction to Chevy's Corvair. If it sells well, this will be taken as an indication that U. S. car buyers are ready to accept drastic engineering changes.

If this happens and U. S. front-drive cars are in the offing, how would they be built?

They would have a differential set squarely between independently sprung front wheels. Half-axles would be connected to the wheels by constant-velocity U joints.

Back of the differential would be a lightweight engine, probably of aluminum. Ahead of the differential would be the transmission. (Kaiser tried putting both engine and transmission ahead of the front wheel centers when it experimented with front drive right after the war. Didn't work. There was too much weight forward, and all kinds of handling, steering, and braking problems resulted.)

Such a car would be lighter than today's standard-size cars. It would have a unitized body with a stub frame bolted on at front to carry the body-drive package—of the kind Chrysler uses now and Cord had 20-odd years ago.

Rear wheels would be sprung independently, improving riding comfort substantially.

The car would be low, yet have ample head room and ground clearance. It would have upwards of 60 percent of its weight, unloaded, on the front wheels. It would handle much like cars we're driving right now.

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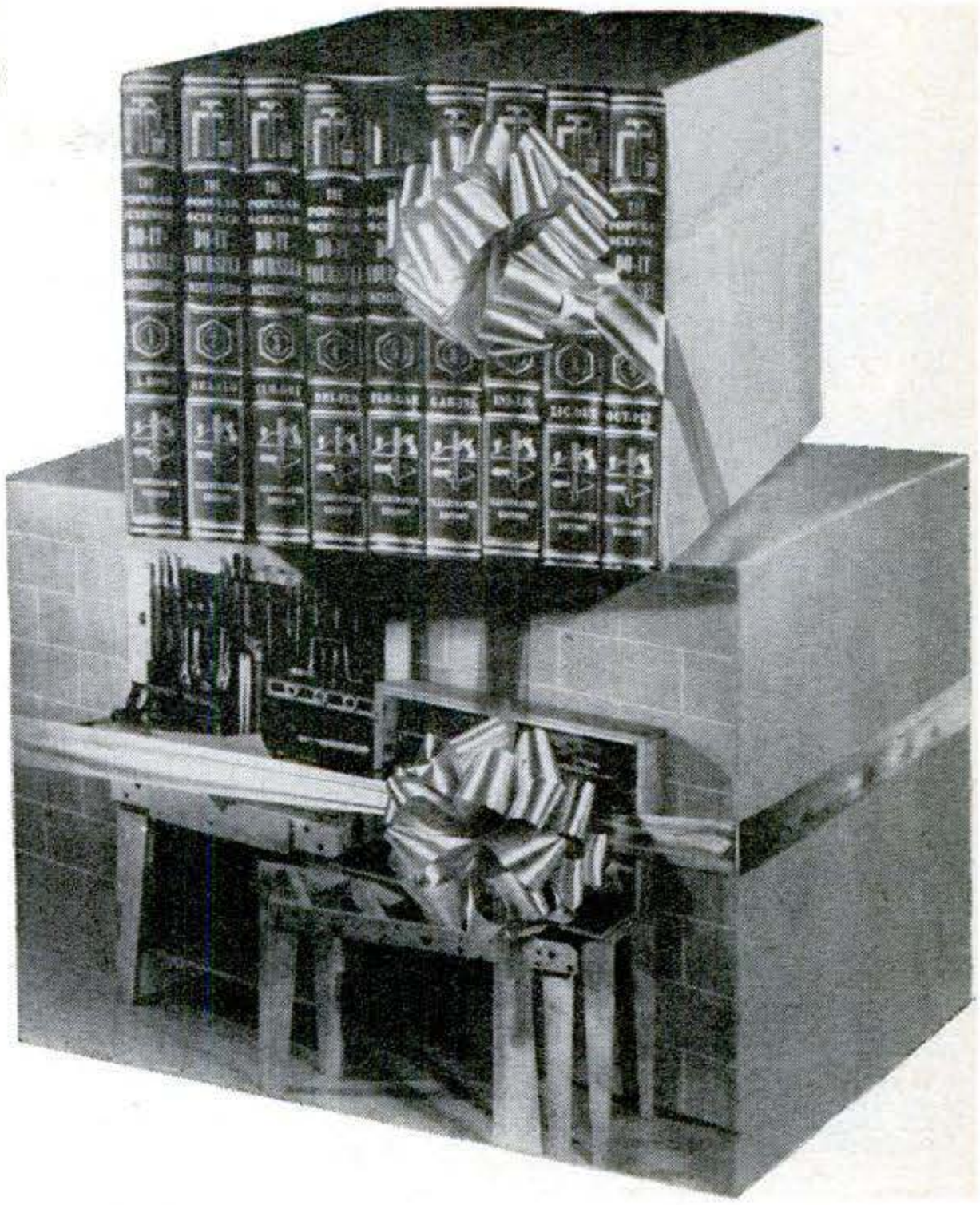

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Electric Tractor Makes Its Own Juice

[Continued from page 71]

Grove built one in 1839. Ludwig Mond and Carl Langer had another crack at it in 1889. Their troubles—mainly with the reaction-hastening catalyst, which "poisoned" quickly and killed the battery—scared others away.

Military demand changed things. During and after World War II, barrels of gold waited for anybody who could invent a power generator as potent as a diesel but as portable as a battery. If it turned out to be cheap, too, you and I and everybody else would become sales prospects.

In England, Francis T. Bacon (yes, a descendant of the great Francis Bacon) dogged this goal. His Hydrox unit, which combines hydrogen and oxygen with the help of a nickel catalyst, produces 150 watts per pound of weight (a lead auto battery turns out 10 watts per pound). A sample lot of Hydrox units will be delivered to the U. S. Air Force (for auxiliary power in airplanes) this year by Patterson-Moos Research, the American patent holders.

In this country, National Carbon (Eveready batteries) put its research lab onto fuel cells in the Thirties, came up two years ago with a unit that uses electrodes made of porous carbon tubes. It also consumes hydrogen and oxygen but has been run on city cooking gas and air. One hefty battery spent a year on loan with the Signal Corps, powering a portable radar outfit at demonstrations.

The big breakthrough, however, came from a Johnny-come-lately to the fuel-cell gambol, Allis-Chalmers, Milwaukee's big old maker of farm and electrical gear. Last year a 20-man team was set to making a cell-powered tractor out of a standard D-12 machine. The result was so successful that it mystifies others in the business.

Allis-Chalmers has somehow managed to make electricity from a cheap fuel—propane mixed with a little hydrogen—at ordinary temperature and pressure. None of the others can do that. They must either run on pure hydrogen, which is costly, or operate at very high temperature, which is also expensive.

A-C engineers are chary of details. They won't identify the electrode, the catalyst, or the electrolyte fluid that

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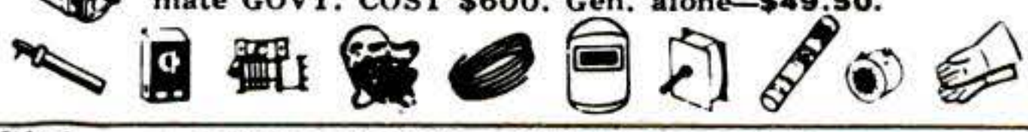

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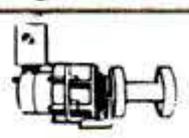

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Electric Tractor Makes Its Own Juice

transports the current inside the cells. They claim that all are simple materials, easy and cheap to mass-produce. And they are now readying a fuel-cell version of a commercial fork-lift truck.

The big promise of fuel cells is for transportation. Any machine-wise 12-year-old boy knows that the internal-combustion engine is all wrong for vehicles. Besides being complex, noisy, and trouble-prone, it won't run backwards or adjust its power output to the job—you need an extra machine, the transmission, for that. The old-fashioned DC motor—the kind used in trolleys—is just right. It's simple, sturdy, quiet, easy to control or reverse. Most important, it automatically adjusts torque to the work at hand, totally eliminating the need for a gearbox. What killed it was the lack of a good way to supply it with electricity.

Now comes the fuel cell to reverse the situation. You can look forward to an electric car, cheaper and pleasanter to run than anything you have now. It will have individual motors at each wheel, for perfect traction and for braking (they'll slow down the wheels by running backward as generators). Under the hood will be a bank of fuel cells. And the gas tank may hold gas, not gasoline. How soon? Five years is optimistic, but not wild.

Fuel cells could also move into your house. Most of your electric bill now goes, not for the cost of generating electricity (that's very cheap), but for construction and upkeep on the wires that connect you to the power plant. Cut out the wires—put the power plant in your cellar—and you might save money.

Another possibility, more intriguing but more distant, is marriage of fuel cells to sunlight-to-electricity converters (the kind used in satellites). They seem to be made for each other. The solar generator would pour out juice during the day, when you don't need it much. But you might store this electricity by running a fuel cell backwards: Electricity coming in would decompose water into its hydrogen and oxygen.

This kind of scheme is the engineer's delight: a closed system. Water changes to hydrogen and oxygen, then back to water again. The only thing that gets used up is sunshine—and the sun shines whether you put it to work or not.

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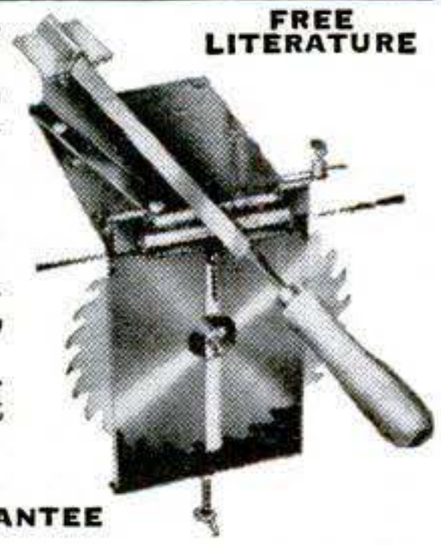

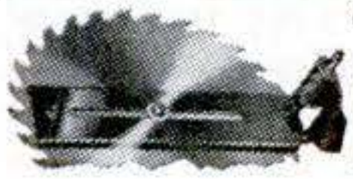

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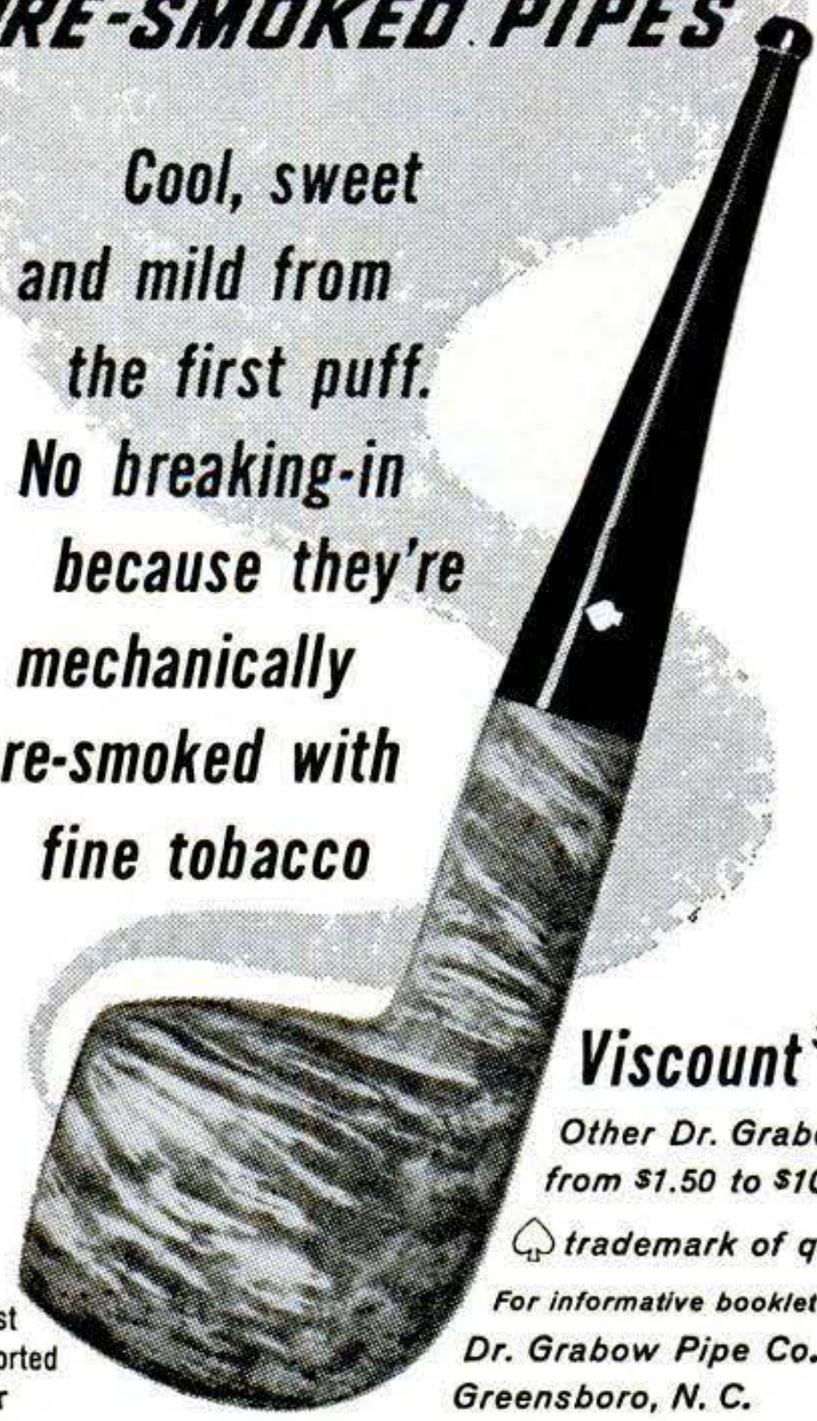

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Nature's Big Sleep

[Continued from page 84]

called induced hypothermia, human beings are now cooled down, sometimes in ice-water baths, to permit delicate operations on the heart and brain. The cooling slows the heart rate and the flow of blood, and reduces the quantity of anesthetic needed.

- Cancer. Cancerous cells grow at an unnatural, explosive rate. If a way could be found to slow down or stop the growth, a great step forward would be taken. Dr. Lyman and his colleagues have transplanted human cancer tumors into the cheeks of hamsters. So far, results indicate that hibernation does slow down the growth of cancer cells; but when the hamster wakes up, the cancer resumes its rapid growth.
- Radiation. Other researchers have exposed hibernating animals to radiation. As with cancer, the effect is only suspended during hibernation.
- Frostbite. "Animals that hibernate," Dr. Lyman points out, "never get frostbitten. We'd like to know why." One theory is that insufficient circulation causes frostbite, and Dr. Lyman may be able to prove or disprove the theory.

Late in 1959, one of his experiments had a surprising result: It showed that, despite the slow heartbeat of a hibernating animal, and the small amount of blood circulated, the animal's blood pressure was remarkably near normal. He theorizes that perhaps the arterioles—small arteries—tighten up, narrow their diameters, and help keep the pressure up.

- Aging. During hibernation, Dr. Lyman's chucks, squirrels, and hamsters may slow down their rate of growing old to as little as a thirtieth of their normal rate. Animals that hibernate are known to live much longer than comparable animals that do not.
- Sleep. It seems probable that we may learn more about this process—especially if both sleep and hibernation are controlled by the hypothalamus. Another thing: Woodchucks and other hibernators probably fall into hibernation from sleep.

Can man, observing in a laboratory, learn to imitate an art that animals took millions of years to evolve? It will take a long time, Dr. Lyman believes; it is at present remote. "But I wouldn't say," he answers, "that it's impossible."

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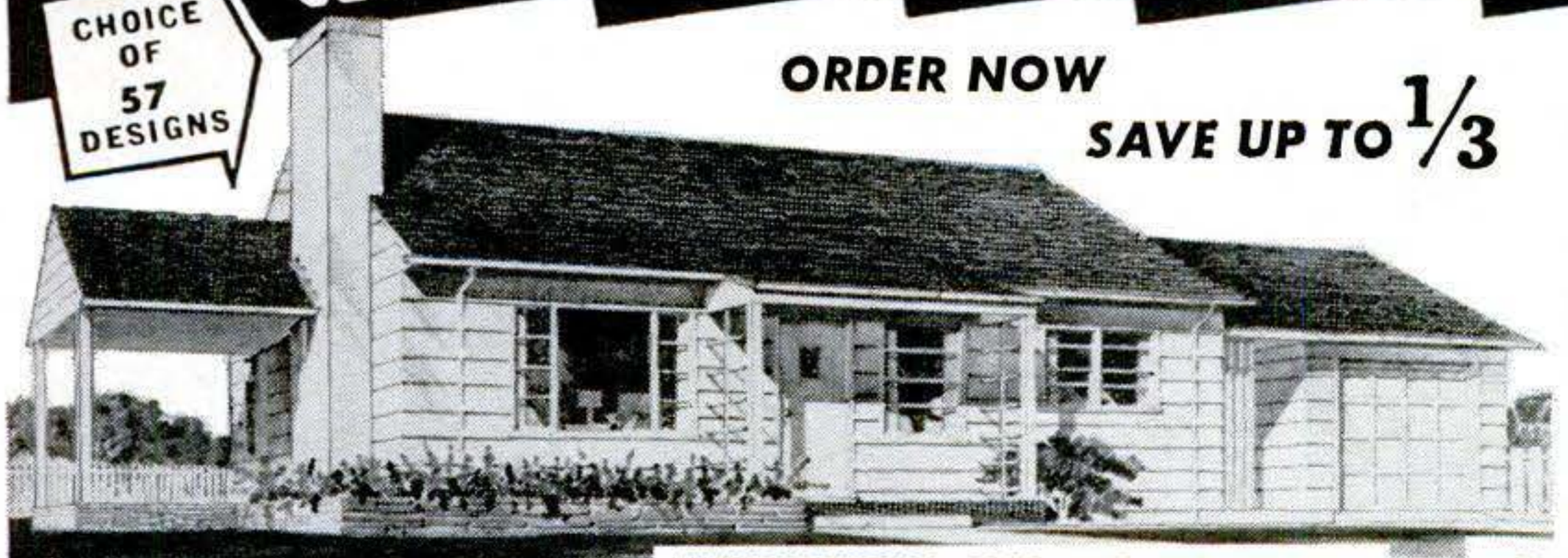

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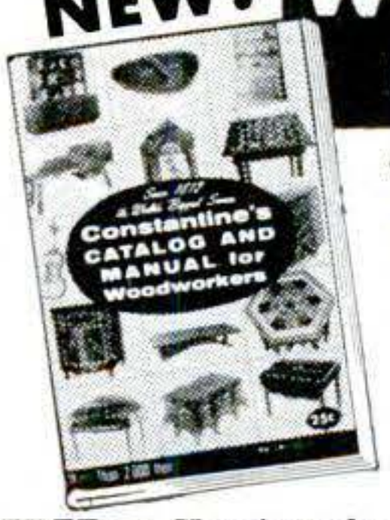

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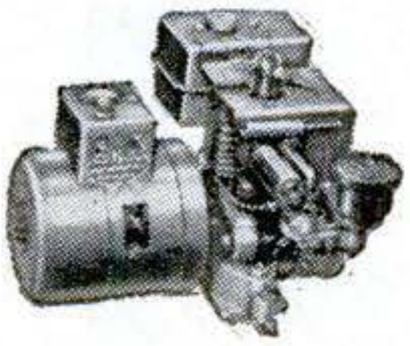

Ordinary light plants must run at full speed constantly. The ELECTRONIC BRAIN, now offered by Porto-Power, allows your plant to saunter along at a thrifty idle until you call for electricity. Then instantly . . . automatically, the plants comes up to full speed with a steady 115 volts of power. When the demand stops, the brain returns your Porto-Power plant back to that same thrifty idle. Saves gas . . . doubles engine life! Porto-Power offers all sizes & all types of light plants to 100,000 watts WITH THE ELECTRONIC BRAIN . . . at prices *less* than ordinary plants! See them at better outdoor stores everywhere. Write, enclosing 10c for our valuable catalog, and the name of your nearest Porto-Power Dealer. Model illustrated is our popular PP 12 (Manual Start). 115 v., 1300 watts A.C. Wt. 75 lb. Priced, WITH ELECTRONIC BRAIN . . **$239.50**

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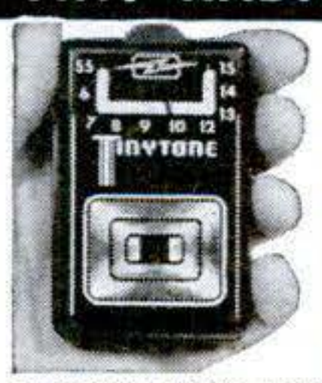

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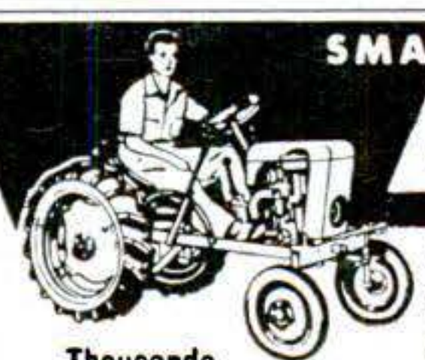

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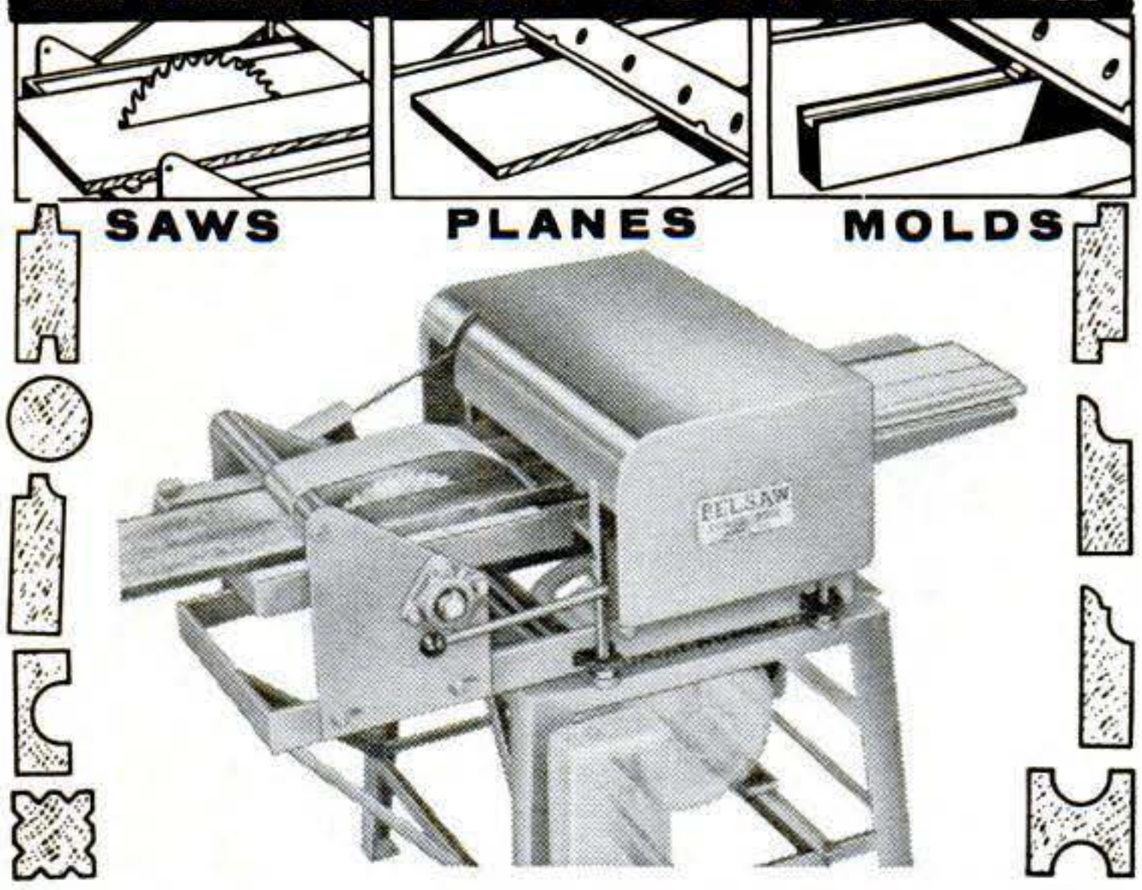

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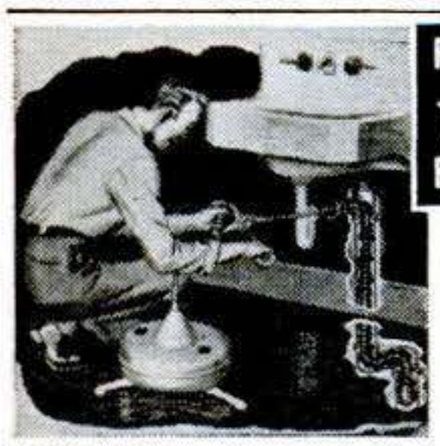

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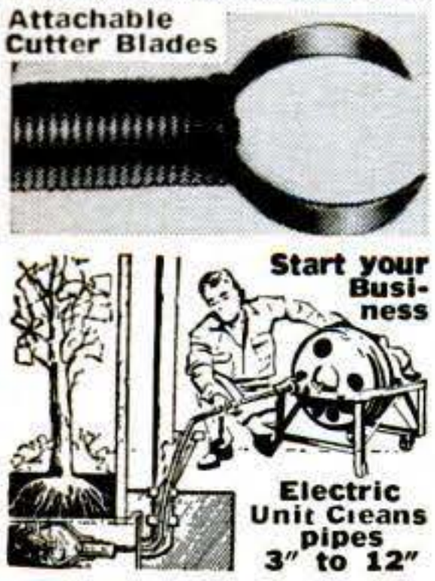
CLOGGED SEWERS
REMEMBER THE COSTLY PLUMBING BILL—

Chicago—Feb. 1. Just introduced is a Free Booklet on machines which **enable** the Home Owner, Janitor or Factory Maintenance Man to Rod-it-himself—

Yet anyone can operate this **new Rodding Tool** which is whirled down the drain in a few seconds. **SINKS, BATHTUBS, TOILETS, URINALS, FLOOR DRAINS, HOUSE TO STREET SEWERS can be cleared of Rags, Grease, Paper, Sand while Cutter blades can be added for removing roots. A new discovery in Swedish Music Wire gives the rod 100% more Flexibility.**

Another new unit is the Miller Electric Rodder which has patented cutters that expand automatically to the size of the pipe. It will clean out heavy obstructions in pipe diameters 3" to 12". Smaller Sizes available. But now, what are these Tools worth in COSTLY PLUMBING BILLS SAVED. Tear this Ad out—and write your name and address beside it for **FREE BOOKLET** on Hand and Electric Units. Obey that urge. No Agent will call. A postcard will do (Chicago Phone Kildare 5-1702)



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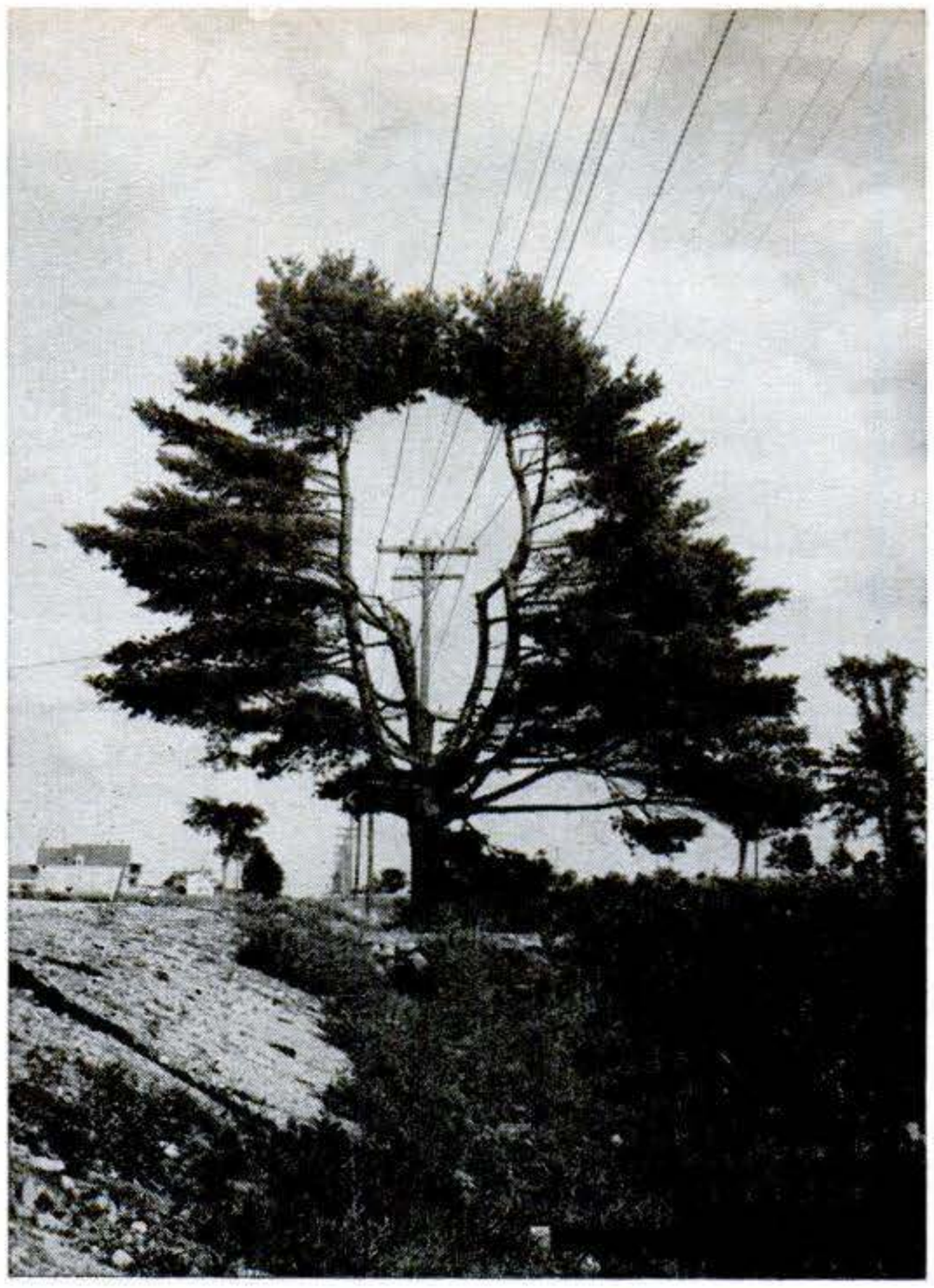
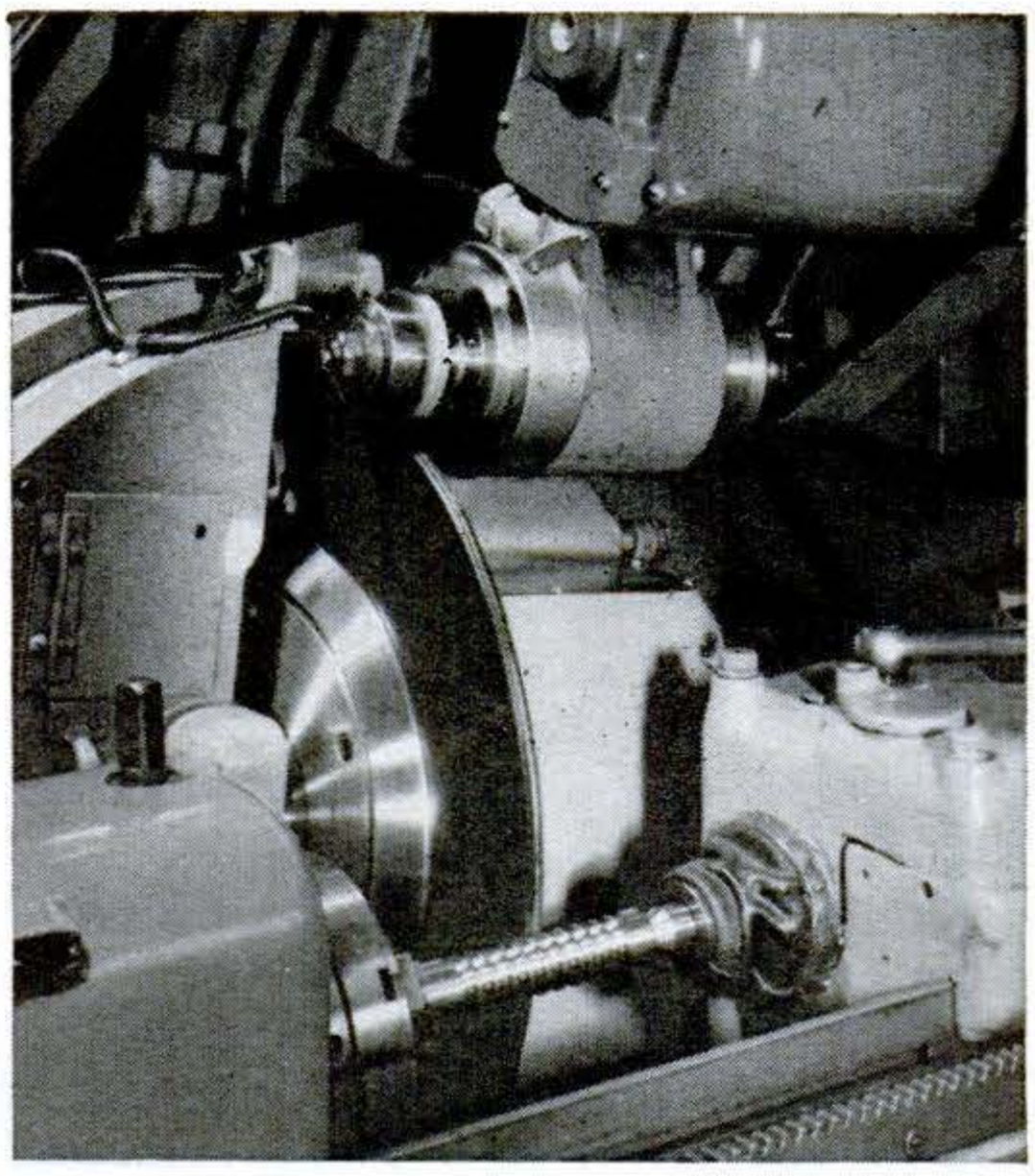


TREE SCULPTURE. Sentiment and progress both won in stringing power lines near Gorham, Me. Instead of chopping down this old pine, linemen cut out its middle, ran their lines on through.



NEVER A DULL MOMENT. As this wheel cuts threads on a shaft (foreground), it is automatically sharpened by the diamond cutter above it. Jones & Lamson built it to eliminate shutdowns.

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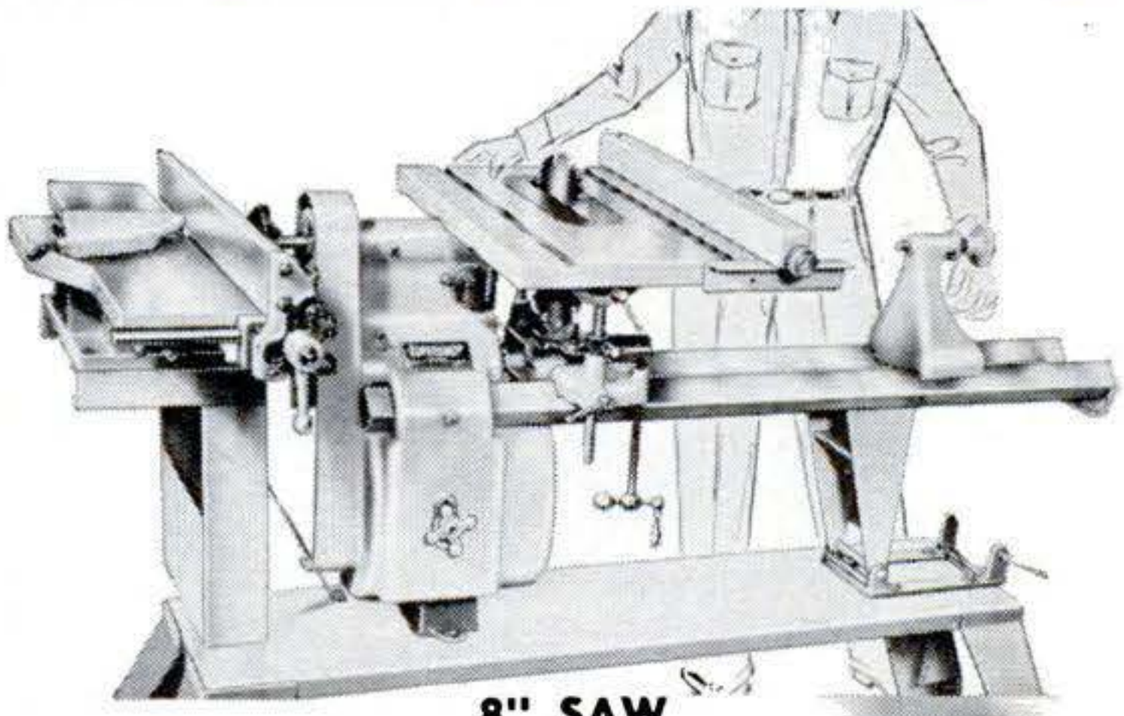

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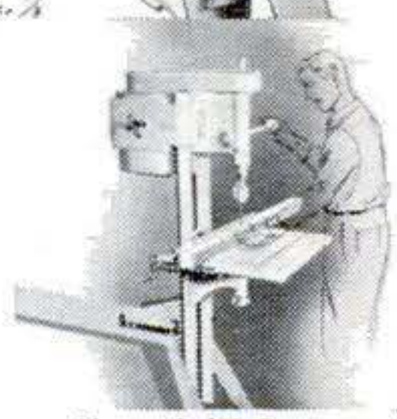

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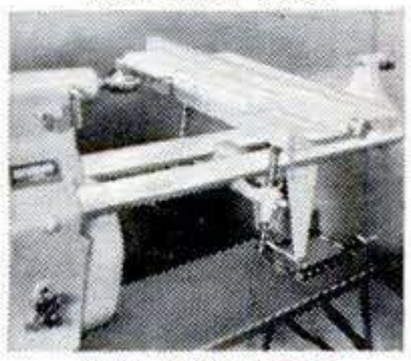
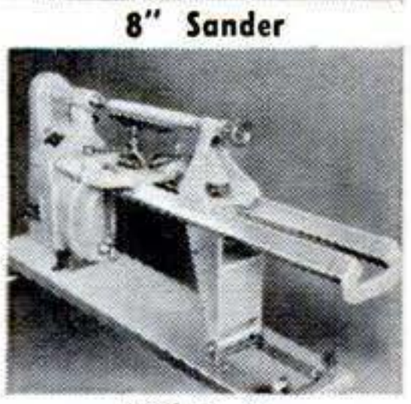
Never before have you seen so much deluxe, precision-built power tool workshop at any price! Designed for the man who wants the best. Massive cast and precision-machined headstock, self-centering inverted "V" bedways (like precision metal lathes), exclusive non-friction speed changer, extra-large cast and precision-ground saw table. 100% ball bearing, lifetime-lubricated. You save by ordering direct from factory. You are invited to test Supershop Model X in your home FREE. Mail coupon or postcard for FREE brochures, photos, details, specifications, accessory list — and amazing freight prepaid FREE HOME TRIAL PLAN. All free.

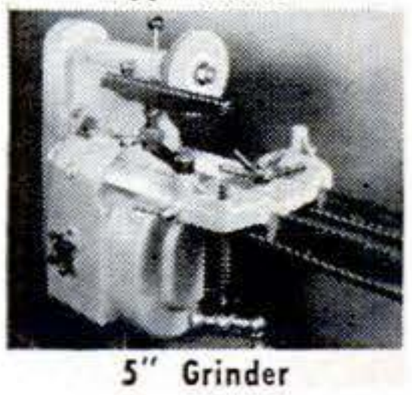


Hor. Drill Press

8" Sander



30" Lathe



5" Grinder

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New 3¾% interest on U.S. Savings Bonds

The Treasury explains why the new ones you buy and the ones you own now are better than ever

Q: How does the new 3¾% interest rate benefit me?

A: With Series E Bonds, this rate turns $18.75 into $25.00 fourteen months faster than before. Your savings increase faster, because your Bonds mature in 7 years, 9 months.

With Series H Bonds, the 10-year maturity period stays the same but more interest is paid you each six months. With both E and H Bonds the new rate works out to 2½% for the first year and a half; then a guaranteed 4% each year to maturity.

Q: When did new rate go into effect?

A: June 1, 1959.

Q: Does the new rate change the Bonds I bought before June 1, 1959?

A: All older E and H Bonds pay more now—an extra ½% from now on, when held to maturity. The increase takes effect in the first full interest period after June 1.

Q: When my E Bonds mature, will they keep on earning interest?

A: Yes. An automatic 10-year extension privilege went into effect along with the new interest rate. This means your E Bonds will automatically keep earning interest after maturity.

Q: With the new interest rate, should I cash my old Bonds to buy new ones?

A: No. The automatic ½% increase makes it unnecessary—and in almost every case it is to your advantage to retain your present Bonds.

Q: How safe are U.S. Savings Bonds?

A: Savings Bonds are an absolutely riskless way to save. The United States Government guarantees the cash value of your Bonds will not drop, that it can only grow.

Q: What if my Bonds should be lost, stolen or destroyed?

A: If anything happens to your Bonds they are replaced—free.

YOU SAVE MORE THAN MONEY WITH

U.S. SAVINGS BONDS

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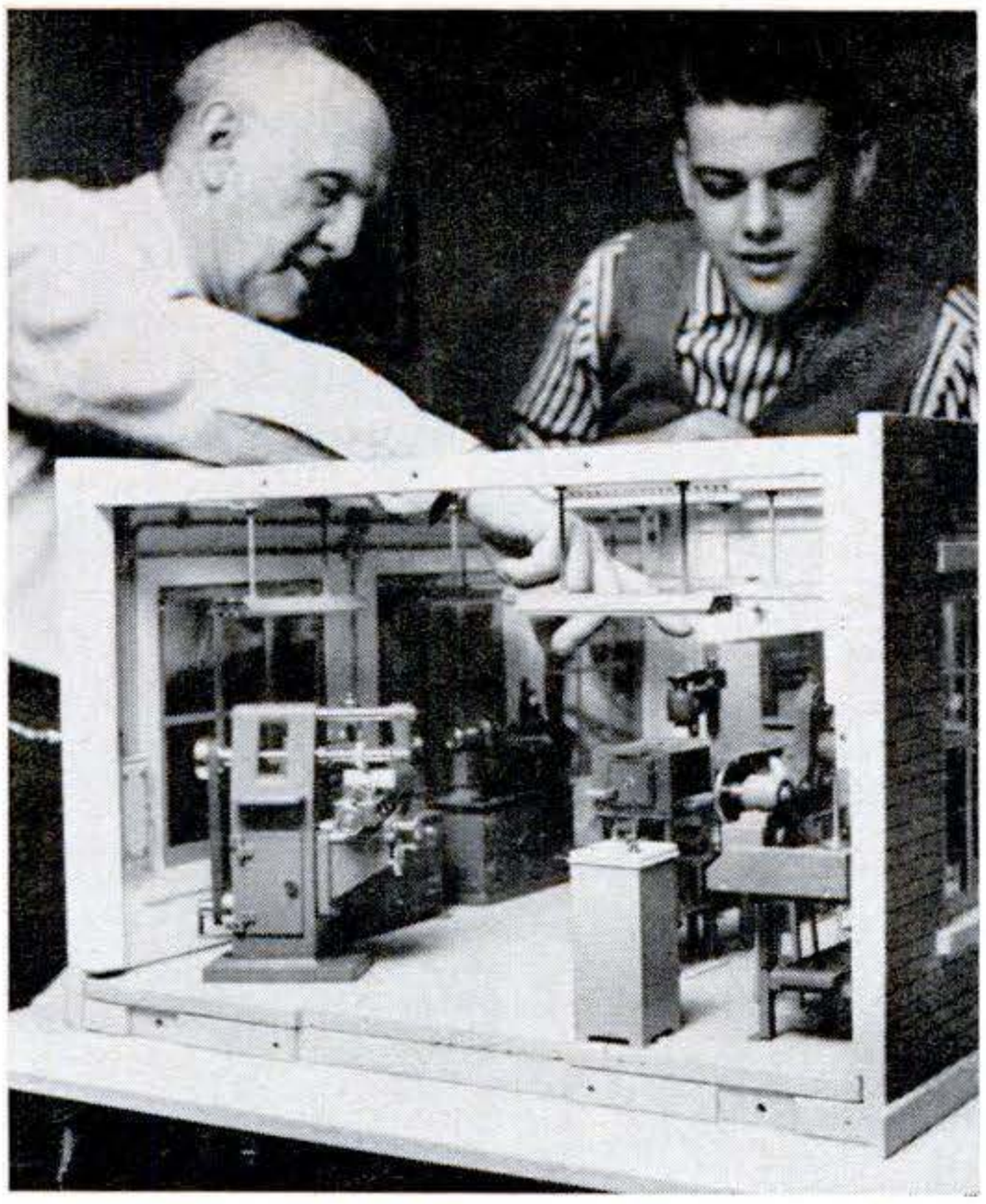

MODEL SHOP. A milling machine, wood and metal lathes, furnace, and tool grinder outfit this tiny machine shop built by 73-year-old Richard Kirmss of Brooklyn, N.Y. All are to exact scale and some are actual working models.

WHEEL RAKE. Here's an odd-looking rake from Germany that not only rakes up leaves but also pulls out weeds. Four middle wheels rotate on a cam drive. Prongs around their circumference uproot weeds as the leaves are pushed into piles.

SAVE UP TO 85% AT PALLEY'S

SAVE ON SLIDE RULES

4 inch IMPORTED SLIDE RULE
Non-warping bamboo with scales on a white nitrate face. Face scales are A, B, C1, C, D and K. Other side has S, L & T scales. In Case. 2.95

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Professional Log-Log, Decimal Trig Slide Rule. Non-warping top quality bamboo with 2-color scale on white nitrate facing. Scales are L, LL1, DF, CF, CIF, C1, C, D, LL3 & LL2 on one side. Other side has LL0, LL00, A, B, K, C1, C, D, S, ST & T. With cursor and 16 page book. 10.95

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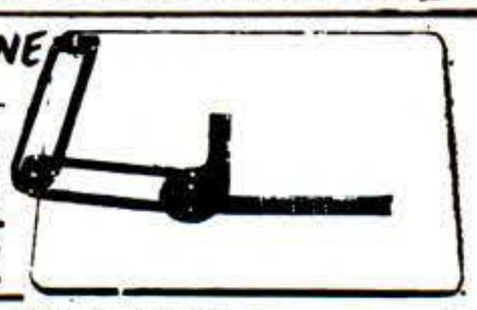

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WINTER COAT

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Palley Cat. price $12.75 . . 9.95

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A variable displacement, piston type pump. Delivers 7½ GPM at 1800 RPM. Maximum output is 15 GPM at 3600 RPM. Has full flow at 1275 PSI. Ports: 1" AN on suction, 5/8" AN on pressure, 3/8" AN on case drain. NEW cond. Only 22.50
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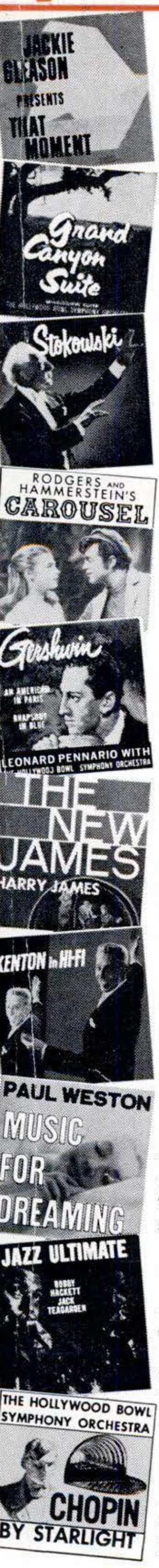

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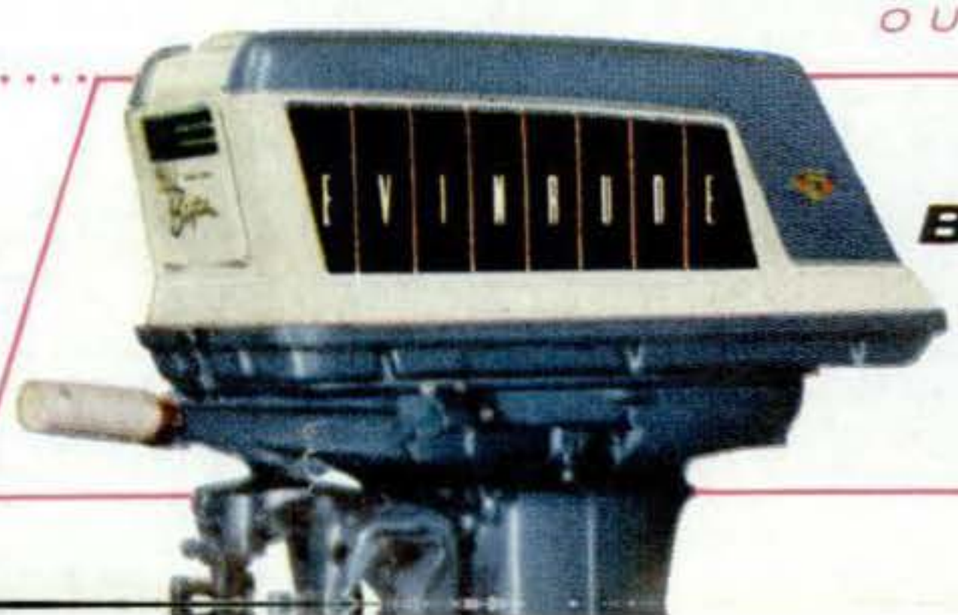

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